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The American Academy of Railway Surgeons

Transactions of the Seventh Annual Meeting, held at St. Paul, Minn., Sept. 5 and 6, 1900

EDITED BY

T. B. LACEY, M.D.

COUNCIL BLUFFS, IOWA

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DR. D. S. FAIRCHILD

PRESIDENT AMERICAN ACADEMY OF RAILWAY SURGEONS

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PREFACE

In sending you this, the Seventh Volume of the Transactions of the American Academy of Railway Surgeons, we feel confident that a perusal of its contents will afford you much profit, and at the same time convince you that the Academy is earnestly striving to realize its aspirations, and that its efforts are crowned with a goodly measure of success.

The Session just closed was one of continued interest and enthusiasm, exhibiting a determination on the part of the Fellows present to persist in the Academy and its task till all interested in similar work are fully convinced that the work of the Academy is of a high character and worthy the aid and support of all active railway surgeons.

Hoping and believing that the papers presented herein will receive a careful reading, we feel confident that all candid and just criticisms will sustain us in our conclusions.

THE EDITOR.

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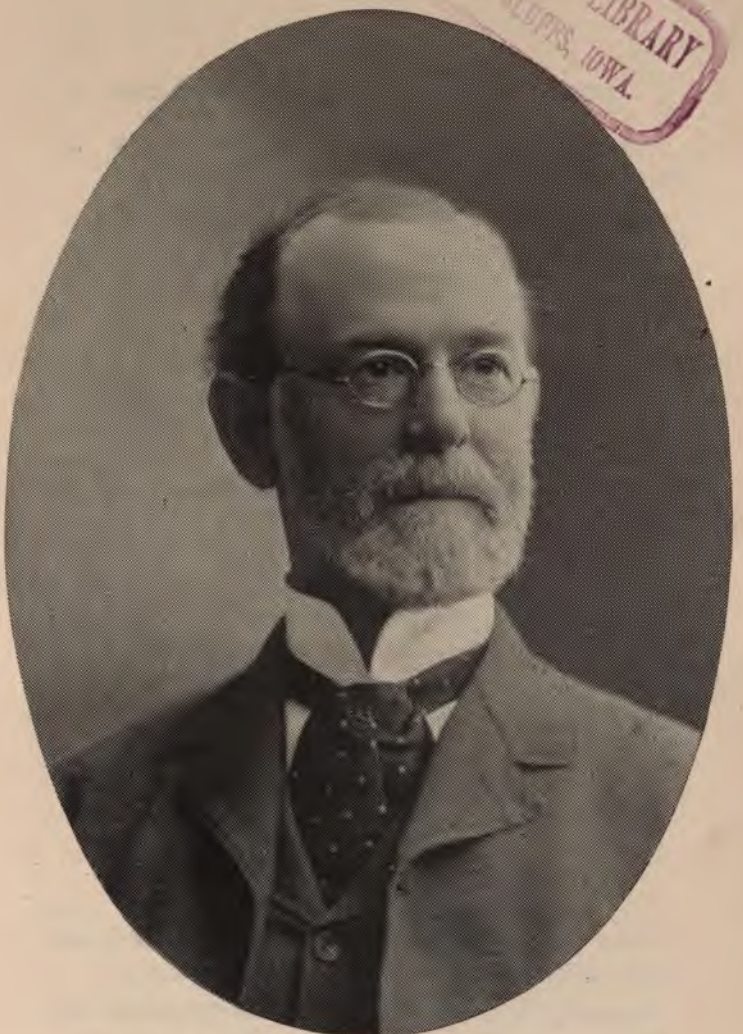

DR. W. W. GRANT

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REMEDIES.

C. O. HUNTER.

GENERAL SOLICITOR OF THE HOCKING VALLEY RAILWAY COMPANY.

The competitions of modern life have become so keen, the requirements so great, the necessities and emergencies so urgent, that an organization, as is yours, under the old-time maxim—"in union there is strength" —greatly assists in equipping each of its members in directing the most scientific inquiry and philosophic research in solving quickest, the most intricate or complicated conditions present, and aided by the most advanced appliances for physiological, anatomical and chemical work, to apply the remedies, most skilfully and effectively for the cure, eradication of disease and the restoration of the injured. The science of medicine is the theory of diseases and of remedies.

The industrious, faithful, conscientious and valorous of your profession are as intrepid soldiers, always on duty, who vigilantly guard, defend and munificently prevent sickness, relieve suffering, restore health, and cleanse, cure and heal from disease and injury.

It should not be expected that a layman could impart knowledge of value to the members of a distinguished and trained body of surgeons; that a railway lawyer, who habitually looks at results to be obtained from exact remedies in judicature to be applied, more than at existing, oftentimes empirical, conditions, injuries received, methods and appliances to be used, and experi-

ments and treatments to be made—the most absorbing and engrossing thought of the surgeon—could contribute information of value.

In the treatment of my subject, for the wider and better benefits we hope to derive therefrom, I have thought best to embrace, perhaps improperly under the head of "Therapeutics" the operative branch of medicine, or that part of the medical art which is concerned with the removal of injured parts or organs, or with the healing of lesions by means of operations on the parts affected. While the skilled surgeon may regard medicine and surgery as distinct, as do the judge and the chancellor, law and equity, and thus travel in separate avenues of thought, in contemplating surgical and medical clinics, yet fortunately the progress of the science of medicine, as of law and equity, has both extended the domain of surgery, and made the relation between it and medicine more intimate, and instead of a separation and an estrangement, they have been bound in closer union, each for the good of the other.

Surgery in its simplest forms is as old as human needs. Skill in the stanching of blood, the extraction of arrows, the binding up of wounds, the dressing of fractured bones by splints, together with an instinctive faith in the healing power of the injured parts, has been common to men everywhere. It does not matter now whether the Greeks got their first knowledge from the Egyptians, or the Hindus first knew how and taught the Egyptians, who imparted the science to the Greeks, or from other sources before or after the campaigns of Alexander the Great.

Of whatever progress had been theretofore made, two things have given surgical knowledge and skill within the past seventy-five years, a character of scientific or positive cumulativeness and wide diffusion through all ranks of the profession: The one was the founding of schools of anatomy and surgical pathology, and the

other the method of clinical teaching, exemplified in its highest form of constant reference to principles. In surgical pathology the discoveries and doctrines during this period were greater in scientific value than those of any antecedent period; it would be unprofitable to attempt any enumeration of them, or of their authors.

The nineteenth century will ever be conspicuous, in the annals of surgery, as that in which the inestimable boon of anesthetics was conferred upon mankind, by which not only has pain in surgery been abolished, but the extent of its operative department immensely enlarged. Of no less importance has been the discovery of the relation of micro-organisms to putrefaction and to infectious diseases, and the consequent introduction of the antiseptic method of treating wounds. A scarcely less noticeable feature of this epoch has been the application of the rules of hygiene to the construction and management of hospitals, by which the general health of the patients has been much benefited, and the mortality reduced. The operative skill of the surgeon has kept pace with the increased precision in physiological knowledge, and surgical operations are now performed on many parts of the body, which not long ago would have been deemed certain death to the patient. Diseased conditions are now treated with a boldness and success which a few years ago seemed impossible.

Science, ever active, never resting, imperturable and inexorable, has made rapid strides, and, after a valorous struggle, finally demonstrated that the theory that fermentation was due to the gases of the air has become untenable. Organic fluids which had been sterilized, could be preserved for an indefinite time in the presence of air which had been previously heated. It was also shown that no gas, *per se,* had any power of causing fermentation. Pure ozone exhalations from putrefying material could be brought into contact with organic fluids and substances without setting up any fermenta-

tive changes in them. The cause of fermentation was certainly not the gases in the air; it was some thing floating in the air, but removable from it by mechanical methods and destructive by various chemical agencies. It was thus evident that excluding merely the gases of the air from wounds was not the cause of putrefaction in the discharges in wounds, and was not even an essential condition of that change, and that their exclusion, therefore, even if thoroughly effective, did not imply the exclusion of the cause of fermentation, or indeed its arrest in any way. It was thus established that the fermentation was due to the entrance of foreign substances or dust from the outer world, and not the action of gases in the air or any changes inherent in the fluids or substances. These facts were being gradually accumulated, which tended to show that unboiled organic materials, among which are to be reckoned the discharges from wounds, obeyed the same law. These invetsigations were being conducted by the best scientists of their time for a considerable period, and as a result of it, it became clear that fermentation was due to the fermentescible substances of particles from the outer world, and that these particles were destructible by heat and chemical agencies. A possibility of preventing fermentation in the discharge of wounds was opened up, and it was this idea that Lister seized on, and which led to such fruitful results. A vast number of observations and experiments had shown that there was an intimate relationship between fermentation in wounds and the constitutional disturbances so apt to follow them, a relation to some extent of cause and effect, and it was therefore reasoned that if the occurrence of these changes could be prevented, vast advance would be made toward the abolition of the so-called "septic diseases." The purpose, therefore, sought was to destroy the fermenting power of these particles before they reached the wound, and thus at once place the

patient out of danger from any of the consequences which are supposed to be connected with the putrid and fermenting state of the discharges.

If the conclusion thus reached was true, that the causes of fermentation are particles brought into contact with the wounds from the outer world, and that these particles are destructible by various chemical means, yet it has been of importance to ascertain more definitely what is the nature of these particles, and this knowledge opened up a wider meaning to the subject than had been before contemplated. It had been known for a long time that in all fermenting liquids, low forms of vegetable life were present, forms which were included in the class termed "schizomycetes," or more popularly known as "bacteria." It had also been amply demonstrated that these micro-organisms did not arise *de novo* in these materials, and were not indigenous to the injured part, but that they were always derived from the parent. It had also been shown that they enter fluids and tissues from the outer world, being present as particles in suspension, in air, in water, etc., or being deposited as dust on surrounding objects. It was also demonstrated, and hence believed, that they must acquire materials for their growth from the substances in which they grow; that they must breathe, be nourished, build up and renew their protoplasm, and excrete waste products. It was then, whether falsely or truly, reasoned that the material which serves them for food must undergo a change as the result of their growth, and since the result of the growth of individual cells in the complex animal organism in the formation from the blood of certain definite substances, there is nothing unreasonable in supposing that the result of the growth of cells floating free in a fluid would be the formation of certain definite substances, varying according to the nature and function of the cells. It will thus be seen that these substances, formed by these particles

of dust, would undergo a constant and definite series of changes, and by reason of their conjunction with a wound they would either produce fermentation or, in any event, encourage it. Where foreign substances or particles united with the wound, producing micro-organisms, causing fermentation, in effect being one and the same, whether the particles gave rise to micro-organism or fermentation, the same vital phenomenon existed, and with the existence of such fermentation, a worse condition was thus probably found by the presence of bacteria and the feeding ground of productive causes thus afforded by the wound than the wound itself.

Confronted by these conditions, and that the presence of bacteria, or bacilli, was the agency which prevented the healing processes of wounds, and because of their presence made particularly fruitless the force and skill of the surgeon, or that because of their presence the fermentation of the discharges of wounds was due to the growth in them of micro-organisms, which came from foreign substances or particles in the form of dust, surgery was confronted with the proposition how best to prevent the presence in the wound of any form of micrococci, or if present, their exclusion, but by preventing their entrance by neutralizing their power afterward.

Science again intervened, and as a result surgery took a long stride forward, and we have what is known as "antiseptic and aseptic surgery," one of the greatest remedies the world has ever known, and that relegated forever the bread and milk poultice and kindred mistakes in treating incised and lacerated or open wounds to oblivion. Until its champions convinced the adherents of the divided views that they were mistaken in their positions, which so long had been advocated by them, that fermentation was due to the action of the gases of the air, and particularly to the oxygen, on the

discharges, or that fermentation was a spontaneous alteration occurring in organic fluids after their exit from the tissues and vessels, and that it was a necessary consequence of loss of vitality, there was not much hope of eradicating putrefaction in wounds and its consequent evils. The scientist recognized that in destroying and preventing the presence and growth and fermenting power of the micro-organism in the wound, that he could not introduce and use agencies which would at the same time be hurtful to the wound. Various methods and remedies, somewhat experimental in their use, were employed.

Science produces most lasting beneficial results, chiefly due to the principles announced, as the cause of fermentation in wounds and the methods of preventing or treating wounds antiseptically, and the methods under which wounds may be brought into an aseptic state. A number of radical changes became necessary to produce lasting or valuable results. For example, in railway service, an operating employee, whether he be working when injured, upon the track, on the train, in the shops, at the docks, or in the coal mines of the company, of necessity, is not free from an accumulation of dust and smudge, communicated to him from the work in which he is engaged. Suddenly he is overtaken and rendered perhaps unconscious by a serious injury, of such a character that his life may be in imminent peril, or that his limbs are mangled, lacerated or crushed to the degree that the greatest skill of past experience has to be applied at the earliest possible moment to preserve life or save the injured part. The injured person may be at a distant point from the surgeon, and before he can be reached or be brought where treatment can be administered, where his wounds can be cleansed and dressed, putrefaction or fermentation has set in. For the successful treatment of cases of this character, it is essential that the utmost care must be taken, not

only for the eradication and destruction of micro-organisms, but not to introduce any septic dust even through water or the less conducting channel of the air.

Whether the germ theory and its treatment, now so popular and well established with the surgical world, is right or wrong, whether in truth the discoverers of bacilli found potential destructive forces. the presence of which are antagonistic to the successful treatment or cure, or whether it is when treating under the microscope, and thus finding that with all animal nature there are simply distinct conglomerated masses of writhing protoplasmic bodies of microbian cells, that in cleansing the patient's wound, the purification of the air, the sterilization of the hands and forearms of the surgeon, his instruments, the applications, the dressings and medicines he may use, whether the philosophy of Pasteur and Lister, or their disciples, show in the progress of time to be inherently false, or not, the one great habit and desideratum of every surgeon, who is conscientious and faithful in the discharge of his duties as such, will have been acquired, in that cleanliness to the last degree will have become an inherent, undeviating, first written law of the treatment of wounds irrespective of what remedy may be applied for the healing of them.

For all past ages the members of your profession have administered to man as a distinct animal. I, in my childhood, was taught that in the creation of man there was breathed into him the breath of life, and he became a living soul; that he was the most highly organized member of the animal world; that from mental and physical endowments, he was far above the highest quadrumana; that even the characters by which he is anatomically separated from the highest apes form a very distinct and appreciable series. Geologic history made him a struggling inhabitant of this sphere long before the time sacred and profane history teaches and

placed him along with the post-pliocene deposits in conjunction with existing species of shells and extinct species of mammals.

Darwin taught us that man descended directly from an extinct form of anthropoid ape, with a tail and pointed ears; Wallace, that of the original unity of man, as the head and culminating point of the grand series of organic nature, but in some degree a new and distinct order of being for a special purpose and guided by a superior intelligence in a definite direction. Carl Vogt holds a plurality of the race, adopts Darwin's idea of natural selection accounting for the origin and endowments of man, but rejects the idea of the higher controlling intelligence. Mivart propounds a theory of a natural evolution of man as to his body, combined with a supernatural creation as to his soul. Charcot has said that men who, through scientific research or special genius, achieve great distinction are insane.

It gives me untold pleasure in addressing so distinguished and attentive an audience of lunatics, to express my faith in the progress and rapid advancement scientific research may conduct you, and that ere long your settled conviction may be, as is now seriously contended by a few scientists, that the human body is not as we used to think, a single animal, but is actually made up something like ten millions of millions of animals, all welded together and helping each other to live. In other words, our bodies are composed of myriads of little masses of protoplasm, called "cells," each having a distinct and independent life of its own. These cells are really very similar to the tiny little animaculæ that one finds in ponds and in every pool of stagnant water. If we place one of them under a microscope, we shall see that it is a little mass of "jelly," which is continually sending out feelers for food, and if it meets with a particle of anything, it engulfs it. We learn that in the human body the masses of jelly are each surrounded

by a dense envelope, so that they have no power to put out feelers. We are told that they are of different shapes in the muscles, lungs, liver, intestines, brain and elsewhere, and each does a certain part of the body's work, or economy, that is to say, there is a division of labor; that the blood brings them all food, and, curiously, the blood contains a number of the animalculæ found in ponds, which forage for themselves. Too, we are told that every one of these cells is a living animal. But, the fat and bone of the body contain none of them, for these are really lifeless substances, on the former of which they feed. On the other hand, the muscles, nerves, heart, lungs, skin and every living part consist entirely of them. A noted analyst makes this unique poetic summary of the subject of your life study:

"What is man but protoplasm!
Poor blind worm;
A kind of cell that's got a spasm,
Poor blind worm;
A particle co-ordinate,
Sprung from an inorganic state,
A heterogeneous reprobate,
Poor blind worm."

"An incoherent organism,
Poor blind worm;
One wonders why the Lord has 'riz' him,
Poor blind worm;
A functionless phenomenon,
Sans differen-Shea-Sheon,
Unspecialized, inert, undone,
Poor blind worm."

"A megatheric parasite;
Poor blind worm;
Mere microbe of a Zo-ophyte,
Poor blind worm;
His liver is morbilious,
Amorphosis commands him cuss—
A mad, morebose homunculus,
Poor blind worm."

"Vain, absolute, subjective Me,
Poor blind worm;
Obnoxious object—that is Thee,
Poor blind worm;
With organisms microbe-crammed
And boojum cell with snarks all jammed,
I guess we can't help being damned,
Poor blind worms."

"But Particle of the Great All,
Poor blind worm;
Rally at Stetson's trombone call,
Poor blind worm;
Homologafe her eunomy,
And eveleot collectively;
Then Man thou shalt no longer be
A poor blind worm."

Are we then at the threshold of a still greater discovery, in the development of bacteriologic technique?

Will you, as your improvements in the methods of research and your knowledge relating to the bacteria, stimulated by the controversy relating to spontaneous generation and by demonstration that various processes of fermentation and putrefaction are due to micro-organisms while you now differentiate a number of species, and generally recognized as vegetable infusoria or unicellular animal organisms—make the further discovery that man's physical basis of life is a composed chromogeous, a micro-organism, indigenous, and that the most poisonous, destructive and deadly agencies exist between the various organisms, and that your greater work of further developed antiseptic methods of treatment is yet to be done in separating the two organisms in preventing the invasion and destroying of the one, and preserving and stimulating the other?

Within recent years a substantial advance has been made from a scientific view in surgery, due to increased precision in physiologic knowledge and careful study of the relation of organisms to various diseased conditions. With this progress, operative skill in many

directions previously unthought of has kept pace. The experimental physiologist has done his part; the clinical observer is now doing his. Of first importance in this advance is the surgery of the abdominal cavity. Previously, the peritoneum was considered a closed book to the operator. Joints, too, are now freely operated on, and if in a state of inflammation, opened and relieved. Inflammatory process subsides, relief comes, the joint recovers. While greater latitude has been given to surgical interference with the different cavities of the body, operations upon the limbs are constantly growing less. Formerly, in the case of compound fractures, amputations were almost universally made, now they are saved.

The term "conservative surgery" formerly had reference to the excision of a diseased joint instead of the amputation of the affected limb. It now has a wider significance, and not only covers the different excisions which have taken the place of amputation, but also those cases in which a limb is saved by careful antiseptic management after severe injury. The question of considerable importance has confronted and does still confront the school of conservative surgery, perhaps due chiefly to the brilliancy of the results obtained by an antiseptic wound treatment and the immunity which resulted from the prevention of blood-poisoning, whereby a limb was saved, when the wound was healed, and yet the limb was of no use, in short, in the way, an obstruction to the proper activity of the management of the body. I do not believe that I am far out of the way to say that conservation in the treatment of an upper limb can not go too far, while in the case of a lower limb, in many instances, I believe the contrary to be true. Unless the saved limb can assist in the performance of its designed functions, and, if it be a lower limb, can support, or contribute freely to the support of the weight of the body, it is far better to perform amputa-

tion, because a satisfactory artificial substitute can be found to take the place of the lower extremity. Always in performing amputation on a limb, the least amputation should be made in all cases commensurate with the part left, with the view of its future utility considered. If a lower limb, every endeavor should be made to obtain a stump which will bear, in part at any rate, the weight of the patient's body. Amputation is now performed under the most thoughtful, steady and deliberate precision. This was not true until the introduction of anesthetics, before which the performance of an amputation had to be done in the shortest possible time to save the life of the patient. Amputation, under anesthetics, enables the surgeon to carefully shape the flaps that the resulting cicatrix will not be opposite the sawed, or severed, extremity of the bone. A good flap, as it is termed, is so essential that, in order to obtain it, the surgeon is justified in sacrificing to some extent the length of the limb, if by so doing he can leave a mobile and painless stump on which an artificial limb can be comfortably fitted. This is not of such vital importance for an upper limb. The pressure on the extremity is not so great, and the longer the stump, the more easily can an artificial substitute be fitted on.

Improvements, too, have kept pace, so that in all cases for absorbable ligatures, catgut has taken the place of silk, thus saving the ulceration which used to be necessary, and which was a destructive process antagonistic to rapid healing.

Free drainage by India rubber and glass tubing, by absorbable tubes made of decalcified bone, by skeins of catgut acting by capillarity, have done more than anything else to enable the surgeon to obtain his triple object: Painlessness, rapidity and safety in the healing of a wound. Lastly, the clear understanding of the "antiseptic" treatment in its fullest meaning, the knowledge of the power which the unirritated and healthy

tissues have as germicidal agents, and the introduction of various antiseptic substances, some of which destroy, some of which paralyze those lowly organisms whose power filled in an unhealthy tissue or injured part, is so great as to contribute toward the same great end. By these means operations are to a great extent relieved of their dangers; by anesthesia, which prevents pain and suffering, they are robbed of their terrors.

Modern surgery has also achieved one of its most signal triumphs in connection with operations performed in those cavities of the body which are lined by synovial and serous membrane. The old-school surgeons did not dare to systematically attack the joints, the cranial, thoracic and abdominal cavities, but the surgeon of to-day performs the most daring operations here with confidence, and is rewarded with success, which at first sight appears to be almost marvelous. In the case of a penetrating abdominal wound, the healthy peritoneum is injured and sepsis gains entrance, and the fermenting exudate is resented by the organism. The peritoneum consists of a sheet of vascular, and is a huge lymphatic, sac covered with epithelium and provided with stomata. It is easily injured and then rapid effusion ensues. Like most vascular structures it heals quickly with favorable surroundings, and the source of irritation having been removed, it speedily returns to the normal. In comparison with the large absorbing surface. the injured portion is but small, and the effusion thrown out at the seat of the injury may readily be absorbed by the remainder of the sac. Confronted by such a wound, the injured parts must be preserved with strict asepsis, by thorough drainage, until such time when the peritoneum shall have recovered its full absorbing power and the excessive secretion has ceased, by careful sponging whereby the peritoneum is relieved, and the wound closed so that further sepsis is prevented and Nature can work out the result. The nursing of a wound or

an injury of this sort is, perhaps, of greater importance than the treatment of the surgeon. Every detail must be guarded with the utmost care, with the proper application of an antiseptic system, the most signal success is produced by means of antiseptics, the secure closing of the abdomen, the proper drainage—its necessity becomes thus marked as experience grows—so that the abdominal wound requires from beginning to end the utmost care, and the specialist or the skilled surgeon who reaches the highest standard of success is the one who combats the shock and who, through rapid, dexterous manipulation prevents hemorrhage, keeps the general bodily condition of the patient good, employs sterilization, and from the beginning to the end prevents inaffective fever or septicemia.

Warmth, stimulants, restoratives and saline transfusions should be freely administered, combined with absolute rest and quietude. If an extrusion of the contents is present, the organ or organs should be carefully inspected, cleansed and warmed; perfect drainage and the most careful treatment by antiseptic and sterilization methods should be employed.

Notwithstanding the vigilance of Congress and the various state legislatures, in taking a most advanced position (much of which has been experimental) in requiring railroads to place safety appliances on cars—in the use of air brakes, automatic couplers, grab irons, blocking of frogs, safety signals, which, with the various other methods the railroads have almost unanimously put into use, together with men of higher character and stricter discipline, the number of killed and injured employees steadily increases. The total number of persons killed during the year 1899, for example, was 2210, and the number of employees injured was 34,923, showing thereby an increase in the number of employees killed of almost 13 per cent. over the previous year, and the increase of almost 10 per cent. in the number of

employees injured. It may be urged that the liability of accident increases as does the density of traffic. Whatever explanation may be offered, we are only concerned here in the conclusion that injuries have increased.

The attention of a surgeon having been brought to an injury, he is confronted almost always by a condition of shock or collapse, which generally supervenes. This is not a situation which alarms the experienced surgeon. He may have both the shock or collapse and the state of faintness or syncope from loss of blood. The two conditions frequently differ in degree only. In a shock, the patient is pale, bathed in cold, clammy perspiration, with a feeble pulse, unable to make any exertion, can only be aroused with difficulty, complains of feeling cold, and may have a distinct chill. The first evidence of improvement is when the pulse becomes stronger; he also complains of the injury, and reaction becomes manifest. If the improvement is only transitory, the patient will sink back again into a drowsy condition, which frequently ends in death. In severe cases there may be no reaction, and with the continued weakening he dies. In syncope from mental emotion, the weakened heart can not drive a sufficient quantity of blood to the brain. After the proper but simple treatment, the insensibility passes away and the patient is quickly restored to consciousness.

An important feature of railway surgery—and in a goodly per cent. a more serious difficulty—confronts the surgeon in the case of hemorrhage. Frequently in severe accidents, and many aside from the hemorrhage are themselves unimportant, bleeding may quickly cause death. For example: A blood-vessel is torn or cut across, the blood within it escapes, either externally onto the clothes or ground, or, in a case of subcutaneous injury, into the tissues, giving rise to "ecchymosis." The important feature then is to arrest the hemorrhage, either

by Nature's effort or by the adoption of artificial means. There is always danger with an arrest of hemorrhage, that the heart's action may recover its power and the bleeding re-commence. Hemorrhages generally occur at the time of the injury, are reactionary, or within twelve hours of the accident, or at a later period caused usually by unhealthy processes attacking the wound and giving rise to ulceration of the coats of the blood-vessels. Sometimes, in cases of severe hemorrhages, it is necessary to supply it from a healthy person, and introduce into the circulation, fluid blood which will give the heart something to act upon. To prevent coagulation of the blood in such cases, all that is necessary is to introduce an aseptic neutral fluid, at the temperature of the body, which has no tendency to cause coagulation of the blood with which it mixes. It may be a saline solution, or blood drained from another, mixed with a solution of phosphate of soda. I mention these two because of their being ready and simple remedies in cases of extreme emergency. The point in treating contused wounds is always to prevent ecchymosis and hasten the absorption of the effused blood after it has escaped into the tissues. Accurate pressure fulfils these ends more perfectly than the commoner application of cold.

Since the beginning of the operations of railways, railway injuries, relatively, as the volume of business has increased, have grown in frequency. The injuries thus inflicted, because of the ponderous and dangerous machinery required in the operation of railways, are of greater severity, more appalling, and in consequence require greater skill and attention, than those inflicted through other agencies, which are generally more moderate and superficial. In the majority of cases the injury is inflicted by a driving force, such as a car or engine, and generally, because it is between a moving force and another of equal or greater weight, standing or also moving. The treatment of injuries thus inflicted

marks the necessity for special consideration of the wounds received in railway work. Due to the special skill, because of the large practice of those who, throughout the country, are designated as "railway surgeons," a marked decrease is noted in those who have lost limbs, or hands, or feet, in consequence. My observation and experience have taught me that a considerable period of time must elapse before the surgeon produces the best results, and that he shall have passed through a period of mysticism and of an enlarged experience for the best appreciation of the gravity and proper method of treatment. For example a fireman, brakeman or switchman suddenly meets with a serious injury, as, for instance, the crushing or mangling of a hand or foot. Before the surgeon can reach him, or he the surgeon, it is necessary for one or the other, or both, to travel a considerable distance. The employee, because of the character of his work, because of the circumstances under which he received his injury, is begrimed and dirty, his wound is filled with cinders, together, perhaps, with grease or oily substance, and has for some length of time been in contact with poisonous (by reason of wicked conditions) clothing, or, frequently, the employee is brought to the surgeon with a temporary dressing of the wound, supplied by some [illegible] [illegible] employee who [illegible] [illegible] [illegible] [illegible] surgeon. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] preliminary dressing which [illegible]

of the case into a most favorable channel. He administers, if necessary, the most modern anesthetics, treats the wound locally with the most effective antiseptics, and the patient and the wound with the best possible sterilized clothing, bandages and dressings, through sterilized instruments and such restoratives as are demanded, and, if the man is able, he is taken to a hospital to be there cared for, or if not, then properly cared for where he is, and all the sufferings and effects of transportation are avoided until he is in a condition to withstand them.

The great frequency with which railway accidents are the subjects of judicial investigation give to the jurisprudence of railway surgery an importance second only to the treatment of the injuries. The surgeon should from the beginning maintain that strict neutrality between his patient and the railway company in whose employ or on whose premises he got hurt. The surgeon should make a thorough observation of the exact conditions surrounding the individual when first seen, of the nature of his wounds, if visible, to obtain, verify if possible, and record then the account as to how the accident occurred, and keep accurate notes of the progress of the case from the day of the injury to its termination. During the period of treatment, the surgeon should faithfully discharge his obligations to his patient, and if he is also the surgeon of the company, he should not show any partiality to either of his obligations. If he makes sure of his prognosis and treatment, there are many instances where it is of the utmost importance to the surgeon to have corroborated his diagnosis, so that he will be fortified in his position, for which he may at a later day be taken severely to task. You are experienced and familiar with the importance of the remedies and manner of treatment of obscure injuries in order to make sure of their identity, and the preparation, from careful examinations, before

advising that a suit could or could not be sustained.

No phase of railway surgery is more important to the railway company than the care that should be taken by the surgeon who has charge of the injured person. It is extremely essential that the injured person's statements should be taken as to the nature of the injury, or its prognosis, for the reason that at a later time the case may have assumed an entirely different aspect, and it may be awkward to be confronted in a court of law with a diagnosis or prognosis hastily made at the beginning of the case, and which because of its incompleteness or faulty statements may prejudice or carry erroneous conclusions. Jurisprudence in railway surgery, meeting as it does with the conditions presented at the time of the accident, thenceforward to the final outcome of the injury, is of that consequence to both the injured and the railway company, that every possible source of evidence surrounding the cause and effect should be produced.

The earnest attention of the surgeon to the obscure points and features which may develop serious lesions should be constantly directed. Guided by his knowledge of anatomy, physiology, and the functions of the body, coupled with his experience in nervous disorders and paralytic conditions, he should be painstaking in carrying out every test and means at his disposal for the completion of a positive diagnosis.

If the surgeon has been thorough in the management of his patient's injuries, he thereby has obtained a knowledge of the true condition of affairs, so that it will be impossible to weaken his position, should the patient become a litigant against the railway company.

If the plaintiff is made to submit to a personal examination, it will but corroborate all that has been claimed and testified to. The results can not only reflect great credit on the surgeon in attendance, but be of the

utmost satisfaction to the railway company, and in upholding and strengthening the ends of justice.

There should be, and doubtless will be, introduced into railway surgery, in a permanent form, a periodical physical examination of all employees of the operative department, so thorough in its method that the service will be thereby raised to a higher standard of efficiency. Under the present system of an examination of an employee before employment, but never afterward, as time goes on, his functions and capabilities wear out and depreciate, and the service thereby is rendered less efficient, and an inequality in the physical and mental capacity of an employee becomes so marked that the railway company is constantly confronted with injuries of a serious financial consequence to it, because of the inability of the faithful but worn-out employee who, through long tenure of service, frail constitution, weakened physical organization, due oftentimes to improper care, dissipation or hard service, is rendered inefficient, and the safety of other employees is thereby endangered, the security of the public is jeopardized, and the property of the shippers and the company is imperiled. If an employee had to undergo a re-examination at a period of every one, two or three years, not too severe but compatible with the best physical qualities and operative capabilities consistent with the duties he was required to perform, the influence and effect would be so good on railway operating departments in their organization and their future results, that the remedies thus applied would be of inestimable value to the railway company and its patrons. This remedy can be made successful and of the highest character only through the efficiency of surgeons. A railway surgeon can through this channel make himself more vvaluable to the railway company, and better subserve the interests of his country through his profession than in almost any other position.

One of the serious problems now experienced by a

railway company is that an employee. who having been in its service from ten to forty years, suddenly is overtaken with a grave misfortune, in which he himself is very seriously injured, for example, a collision, the result of physical infirmity, failing sight and hearing, or discernment, proper distinction of signals, or application of air-brakes or other mechanical devices. An investigation may disclose that the employee, an engineer, had done everything that he was required to do, but that the catastrophe was not averted. A diagnosis of his injuries discloses various contused wounds and internal injuries, some of the latter of which may have existed for a long time before the accident, but come to the knowledge of the company for the first time afterward, and can not be determined definitely to have existed before, and that were not caused by the accident. Other persons are hurt, and a large amount of property destroyed, the company not having had in force a system requiring frequent examinations to determine not only the physical but mental qualifications of its employees. Inquiry naturally arises: "What shall a company do with its worn-out employees?" They have been efficient, faithful and loyal. In order to provide for them during the residue of their lives, some of the companies have already taken the final necessary step, that is, provided positions for them in shop, offices and elsewhere, where they can render services as necessary and valuable, but where they are removed from danger or endangering the lives of others or of property, and by providing a fund whereby a difference in their compensation is thereby practically made, and when enfeebled —no longer able to perform any service—to provide a fund out of which is paid to them, based on a schedule made from their earnings during the period of full activity, for the remainder of their lives.

Here again a remedy is provided, a solution is found, and the surgeon is the responsible factor in railway

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service to apply them. Under this system the surgeon takes the primary responsibility, and is the efficient cause of the retirement of the employee, and thenceforth those once active, faithful servants, now infirm, are committed to his care and protection until they reach the final terminus of their run, and make out and hand in their report of duty faithfully done to the Master of us all.

In conclusion, viewing the subject of your work, the remedies now used, the improvements, which further research will bring to you and therewith the insight, whether because of inventions, surpassing in importance the use of the *x*-ray, anesthetics, antiseptics, sterilization and further and close analysis of micro-organisms, I have no hesitation in expressing the thought that the early future is pregnant with discoveries far greater than those of the past. Indeed, I am complacent in the thought that surgery, as a feature of railway operations, will keep abreast with other branches.

From the tendency of modern research derived from the inorganic world with which we approach the consideration of the phenomena that belongs to organized beings, we commence the examination of this material structure and find it so very different from everything we have met with in lifeless matter, that we are tempted to believe that it must differ no less in elementary composition.

Chemistry has met us with her all-searching analysis, and has told us that this solid and this fluid, and all the other structures of the body, however varied in aspect, are but combinations of a few elements which we know in the laboratories of nature and art. In the composition of man, we have a few gallons of water, a few pounds of carbon and of lime, some cubic feet of air, an ounce or two of phosphorus, a few drams of iron, a dash of common salt, a pinch of sulphur, a grain or more of each of several hardly essential ingre-

dients. Here then we have a living structure; here are solids sustained and fluids lifted against the force of gravity; here is heat generated without fire; here is bread turned into flesh; here is flesh turned into blood; here is a glairy and oily fluid shut up in a tight casket sealed by Nature as carefully as the will and testament of a dead millionaire of impatient and dependant heirs. What the casket holds is juggled into blood, bone, marrow and flesh by the aid of a little heat. and we have new forces unknown to the common forms of matter, and that deceived us respecting the substances of the organism until the chemist set us aright. He, with the physician and the surgeon, has analyzed and prepared a synthesis and physiological construction, so that we have the most delicately adjusted conditions. Each organ is supported by and accountable to the general system. Life is adapted to maintain a certain part of the atmosphere as much as the atmosphere is to maintain life.

All of the physical laws, in and out of the organism, are arranged in harmony with one another. When each of us was born he at once opened an account with Nature —debtor by so much carbon, oxygen, hydrogen, azote; creditor. by so much carbonic acid and ammonia, or whatever may be the medium of payment. It appears from the survey we have taken that we might expect from the general character of the creative plan that as pre-existing materials were employed to form organic structures, so pre-existing force or forces would be employed to maintain organic actions or unconscious life. It is certain that the materials of the organism are to a great extent subject to the common laws of mechanical and chemical forces.

The remedies which you have found for the amelioration of diseases, the healing of wounds and the prevention of sickness prove that the more you vary your experiments and extend your observation, the more diffi-

cult you find the task of assigning limits to their power. The exigencies of railway surgery are such because of the tremendous risks and hazards to life and limb, the character of the men employed, their youth and vigor, their fitness, through long training, solely, for their vocation and thereby disqualification for any other work and their imposed obligations to their families and state, that your profession wisely has not depended upon methods used before they arose.

The collation of your vast experiences from year to year, aided by the ever-developing chemical results, will go forward producing remedies for the relief of suffering, the saving and healing of the injured and mangled parts that heretofore have been unknown or believed to be impossible.

If new formulæ of forces in combination with matter preceded the creation of each organism, or organisms, we can understand that a special *vital* formula may be involved in the continuance of their existence.

In the view we have taken, of micro-organism, leaving to you to prove whether the present prevailing theories are true or but experimental evidence or hypotheses not inconsistent with the laws of matter and assigning to the physical forces in the production and phenomena of life for mysteries to be solved and discoveries to be made and remedies to be applied to work out a seeming perpetual miracle, in which the Infinite Creator works through you as secondary causes, is Himself the moving principle of the universe; He first framed and never ceases to sustain.

DISCUSSION.

DR. W. W. GRANT, Denver, Colorado—The distinguished gentleman has given us a good lecture on surgery, and he has talked a little about law. At any rate, he has advanced certain phases of the relations of the railway surgeon to operations that are of much interest to us. I was particularly interested in listening to the statement as to the usefulness of a leg or foot as compared with an arm or hand—a principle which

surgeons have recognized for a long time. It is not clear in my mind that if a surgeon should amputate and cure the leg of a brakeman in one month, for instance, which leg he might possibly save in five months, though crippled, by careful, judicious, conservative treatment, whether or not attorneys and juries in our courts would sustain him, although it would be better for the man from a useful standpoint. In operating, no conscientious surgeon would do such a thing without a considerate regard for the future usefulness of the limb, and we know that its future usefulness and even the interests of the patient's family might be subserved by its loss. An artificial limb is in many cases worth much more to these men than a bad leg saved by long continued conservative measures, though, beyond saving life, it is considered our first duty to conserve the limb. We should always do what is best for the patient, but the question arises: Would we be sustained by attorneys and courts? This question we can not answer; perhaps the attorney can.

As to the re-examination of employes, the Chicago, Burlington and Quincy Railroad has instituted the plan of pensioning its worn-out employes. Most of the railroads in the West are requiring physical examination and excellence on the part of their employes. There is no doubt but that this is one of the greatest advances that has been made in railway management, because we know so many accidents have been due to either color blindness or disease. It is surprising to most of us that such a reform has been so long delayed.

Mr. C. O. Hunter, Columbus, Ohio—I want to make one statement in reference to the remarks of the previous speaker. The gentleman has pleased me very much in what he has said. I will mention three examples bearing on the points brought out in my paper.

Harry T. had his toes so badly mangled as to require amputation. He was a brakeman. The surgeon, who did the work in his case, saved just the heel of the foot; he could have saved more of it under aseptic treatment. Three months later, after complete healing of the wound had taken place, the patient came to my office. I gave him a position on a passenger train as brakeman, and did not see him for three months thereafter, when, in passing through the sleeping-car, he said: "How do you do, Mr .Hunter?" I said, "Who are you?" and he replied, "I am Harry Thornton." He was clean, well dressed, and told me that he was the man who had lost his toes, and added that it was one of the best things that ever happened to him financially. Formerly he got $40 or $50 per month, but now he is getting $65 per month on a regular run. He told me that he was never better in his life physically, and one could hardly determine which foot it was that had the artificial member

on it. Here is a case where the surgeon saved enough of the man's foot to make him very useful, and as the result of it he is earning more now than he ever did.

Another case was a dock stevedore, for whom the surgeon saved an entire arm, which was badly mangled, and hung like a dead limb to a tree, utterly useless apparently. It seems to me that the arm of this man ought to have been severed near the shoulder joint.

A third and best example was that of C. L. S., a freight conductor, a man 32 years of age, young, robust and strong, who had been in the service of the company for a long time—I think, for seven years as train conductor. From neglect to put out a flag, the following train dashed into him just as he was getting out of the caboose. He sprang from the train as the collision occurred, and sustained three punctures through the leg at the knee-joint, with two fractures above the knee, and one below it. I got telegraphic reports every fifteen minutes for an hour or two as to his condition. The surgeon was a new man. I instructed him to apply the best conservative surgery to his case. He called an adjoining county surgeon, who was old and experienced, and who advised amputation of the leg. But the young surgeon saved the limb, and as a result this man can not go back and earn $100 per month or more, a sum which he was receiving prior to the accident, simply because his leg is absolutely stiff at the knee. There is very little shortening, perhaps an inch, or may be not as much as that, so that he is now relegated to watching crossings, for which he receives about $30 per month. He is a bright man, and might have worked himself up to be superintendent of the railroad. Here was a case where the leg ought to have been amputated. It may seem a little hard-hearted to say that if he had died it would have been better for all concerned. Had the leg been taken off between the knee and thigh joint, and an artificial limb applied, this man's services would be much more valuable than they are to-day, and he might have been able to have continued his occupation for many years with an artificial limb.

If the surgeon is of the right character, and should amputate any of these limbs that are badly crushed and mangled, I believe the courts will sustain him. We know that many of the legs that are saved by conservative means are absolutely useless in that they are as stiff as a poker, and the men with such legs are unfit for anything except flagmen watching crossings.

Dr. J. T. Eskridge, Denver, Colorado—There is one point I desire to mention in connection with the second case reported by Mr. Hunter, with reference to useless limbs. It shows the necessity of railroads employing competent neurologists. Had this limb been examined and tested by electricity, and the presence or absence of reaction of degeneration noted, it

would doubtless have shown that the nerve injury was the cause, not injury to the bone, and with such an injury, if it could not have been repaired, the limb should have been amputated. We know that nerve injuries can be repaired within ten months or even more after the nerves have been severed.

There is one other point which might be taken up in Mr. Hunter's address regarding nerve injuries. These injuries can only be determined by careful examinations by an expert neurologist at the time of the injury. I recall two lawsuits brought against the Union Pacific Railroad, one for $7000 and the other for $5000, both of which were paid. In one case, shortly after the injury the man brought suit for damages. It could not be determined how long the injury had existed, but there were the reactions of degeneration, showing organic lesion of the leg, it being due to nerve lesion. After the suit was over it was found out that the man had had infantile paralysis some forty-five years before.

Another case was that of a man who received an injury on the Colorado Southern, this road being then under the charge of the Union Pacific. It was learned that five years before he fell from a carriage and had developed as a consequence thereof paralysis agitans. He did not come under the care of the railway surgeon, but a private physician. Six months afterward he brought suit against the company; paralysis agitans was found, and on the witness-stand testimony was given to the effect that it was due to the recent injury which he had sustained, when, in fact, it was due to the injury that he had received five years previously.

Dr. T. B. Lacey, Council Bluffs, Iowa—I wish to say a word or two in regard to the re-examination of employes. I believe that these examinations ought to be made at intervals, not only at the time a man first enters the employ of a railroad company, but at intervals of, say, every three or four years thereafter. There is one feature that strikes me that ought to be brought about by some means or other, and that is to get the management of railroads to acquiesce in the judgment of surgeons making these examinations. I know of cases of railroads where this is not carried out, and where in many instances the surgeons have very little influence over the operating department. Whether the legal departments of railroads can advise in this matter and bring about certain results for us I do not know. I have in mind an instance which occurred in Council Bluffs within the last two or three months. A young man, who was braking for a certain company for a longer or shorter period, came up for examination. He was examined by the surgeon and pronounced color blind. This was not satisfactory to some of his friends. He also

consulted an oculist, who also developed the fact that he was color blind. After these examinations he went back to his foreman; the division superintendent happened to be on hand, and asked what the trouble was, and the young man told him that he expected to quit work. It is said that the division superintendent told him that he had worked with the company such a long time, and did his work so well, that he could resume his work and continue until he told him to quit. If such men are permitted to continue their work after they have been reported to be color blind by the surgeon, I hardly know where the fault would lie in cases of accidents occurring thereafter.

MR. HUNTER—Certainly the surgeon would be relieved from responsibility in such cases.

DR. W. L. ESTES, South Bethlehem, Pa.—I wish to say a few words as to what follows sometimes after well-directed efforts at conservatism, and how patients themselves view the efforts of the surgeons subsequently. I have in mind a case in which we endeavored successfully, after a number of weeks, to save a badly crushed leg. The leg was so badly mangled that we almost despaired of it, and if it had not been for the bad condition of the patient at the time of his admission to the hospital we would have amputated it. As the result of several weeks' treatment the man had excellent function; he could move all of his joints, and could walk almost perfectly on the extremity, but complained of constant pain at the site of injury, and claimed that he was incapacitated on account of that constant pain. He returned for further treatment, and upon examination I found that there was actual cause for the pain, namely, a branch of the musculo-cutaneous nerve had been cut and bound down under a cicatrix. This was relieved, and afterwards there was absolutely no physiological reasons why that man should have pain. But he was thoroughly dissatisfied, and claimed that he did have pain, notwithstanding the doctors could find no reason for it. On account of this dissatisfaction he finally went to another surgeon, who amputated the limb. His idea is to sue his former surgeon for saving his leg and having a good functional result. What are we to do about these cases?

Another point: We can not, in attempting conservative efforts, think only of one occupation for a man. For instance, if we have a young man who intends to follow railroading as an occupation for the remainder of his life, it would of course modify our treatment perhaps. It seems to me, as surgeons we should do what is best for the physical organism, and the individual should be considered as an individual, because we have to take that into account, as well as the commercial value of a man with reference to any one occupation. We

should strive to put a man in the best possible condition for earning his living, whether he be a blacksmith, a railroad conductor or a brakeman, etc.

I have an antithesis to Mr. Hunter's case of a railroad man whom I treated conservatively, and who was left afterwards in a condition so that he was not able to continue his avocation as a conductor. He went into politics, became a very successful politician, and in a few years earned much more money than he did as a railroad employe. It is a rule that may work in a good many ways.

DR. J. P. LORD, Omaha, Neb.—I was particularly impressed with the fact brought out by Mr. Hunter, that notwithstanding all of the improved conditions, which I will not stop to re-enumerate, the number of injuries and deaths from railroad accidents is increasing. The fact is so startling to me that I can scarcely accept it, although it is doubtless true. It illustrates very forcibly one thing, and that is the need of a more thorough organization of the medical departments in railroad work, so that such subjects can be given the attention that their importance deserves. This matter is of vital interest to railroad corporations and to their employes, and of course it concerns very materially the railway surgeon, and it would seem that railroads are not employing sufficient help for some reason or other to make a proper study of the causative relations of railway injuries. I am not in a position to fathom this subject, and would therefore like to hear from some of those who are in a position to know of these things and to give us some light upon them, making some suggestions in explanation of the apparently anomalous figures cited.

DR. W. J. MAYO, Rochester, Minn.—I did not intend to make any remarks on this address. If I understood Mr. Hunter correctly, he advised against the saving of limbs which were almost certain to be useless. I believe all modern surgeons agree with him in that regard. The modern surgeon frequently, under antiseptic and aseptic precautions in the care of wounds, saves parts of limbs that might much better be taken off. I think if necessary this should be done secondarily. The surgeon should exercise judgment, and if he thinks a limb is not likely to be useful afterwards, it should not be retained, but amputated at a later date. With reference to the re-examination of employes, this matter should be brought to the attention of the general managers of railroads. The surgeon is a kind-hearted man; he very much dislikes to turn down any employe who is giving faithful service and who has done so for a long time, and the general managers should see to it that some adequate compensation or occupation is given such men to make a living. If that can be done, I am sure railroad surgeons will make thorough and compe-

tent examinations and direct what shall be done. Some such provision should be made before the surgeon takes the initiative in turning such men down and assuming the responsibility.

Dr. C. K. Cole, Helena, Mont.—I did not expect to be called upon to discuss this paper, for the reason that I did not hear all of it. However, as Mr. Hunter read an interesting paper three or four years ago in Chicago before the Academy, I can take it for granted that the one he has read to-day is likewise instructive and equally interesting.

The paper covers too much ground for an ordinary five-minute discussion. There are certain phases of the paper which impressed me very much, and one was his reference of the railroad surgeon to the company and to the patient in connection with suits or possible suits. This old question has been discussed many times in this and similar organizations, and Mr. Hunter brought it very properly to a point which is pretty generally agreed to, and which still remains with some of us unsettled, and that is the witness as a witness (I am referring now to the railway surgeon) should be strictly non-partisan. With all the teaching and writing and discussions that have been had on this point, unquestionably there is still a tendency on the part of railway surgeons to regard it as one of their functions to take a partisan view, and give testimony in the interest of the company rather than in the interest of facts. This is a matter of the utmost importance to those who are interested in this work. We should divorce ourselves from any idea of partisanship. As surgeons, familiar with our work and our duties, possessing some knowledge of medico-legal matters, if we are called upon to give testimony in the courts we should do so from a strictly professional standpoint.

I must take some exception to Mr. Hunter's remarks in which he illustrates the value of conservatism in surgical practice in the line of amputations. Case No. 3, if I understand his recitation of it correctly, does not show that the surgeon makes the mistake frequently in attempting to save a limb. I save many limbs that are partially functionless. In other words, a leg that would be stiff from ankylosis of one or more joints, I would try to save it rather than cut off the limb and trust to an artificial member. This sentiment may be changed in the future. We may reach a point where we will be warranted in doing otherwise. But it is not in consonance with the best teachings of surgery to cut off a limb that we can save. There is no surgeon in this room who would assume the responsibility of cutting off a leg because he knew that the man would have ankylosis of one or more of the joints.

Dr. John E. Owens, Chicago—It is not easy to determine whether we shall attempt to save a leg or not. In a number

of instances I have saved legs when I subsequently thought the patients would have been better off if I had removed them. I have such a case in mind. A patient sustained a fracture of the femur at its lower third, and a simple fracture of the tibia at its lower third. The ankle joint was torn open at the expense of its outer portion, the external malleolus was destroyed, and the peroneal tendons were so uncovered as to their sheaths as to subsequently slough. The base of the fifth metatarsal was crushed and the joint laid open, making a compound fracture; besides, there were various contusions, scratches and abrasions. This patient was wildly delirious for two months. I have never seen a worse case of traumatic delirium. The patient gave the nurses, the assistants and myself an extraordinary amount of work. We saved his leg, and he is now making a living as crossing flagman. For a considerable time he complained of so much pain about the part that I wondered whether he would not have been better off had the leg been amputated.

I am fully in accord with the sentiments expressed by Dr. Cole, namely, that we should endeavor to save legs if we can see our way clear to do it, and if such patients are disabled 50 or 25 per cent, it would still seem to be our duty to carry conservatism to the degree in question.

In the case I have referred to, owing to loss of the peroneal tendons, and there being some deflection of the foot inwards in consequence of the action of the anterior and posterior tibial muscles, I was obliged to cut their tendons. The patient wears an elastic stocking. There is some swelling about the lower part of the leg, but he is able to get along fairly well. I have not seen the patient now for two months, but I believe he is still performing his duties as a flagman.

Surgeons have appeared in court time and again for cutting off legs that might have been saved, and it seems to me an important point to be entered into is whether the saving of a leg would be considered a disabling injury or a partially disabling injury.

So far as the re-examination of railroad employes is concerned, I regard it as a very important matter, and I think it is particularly essential during that period when we may expect organic disease when the organs are becoming more or less disabled and the special senses more or less impaired.

Dr. J. P. Lord, Omaha, Nebraska—We want to arrive at the truth if we can. I may have misunderstood Mr. Hunter relative to the statistics given by him. I understood him to say that there was a greater number of injuries and a greater number of deaths from railroad injuries at present than at any time previously. The question arises as to whether this material increase in injuries and deaths is not due to the in-

creased traffic, the increased size of trains, and all those things which have entered into it as causal factors during the last few years. These things would of necessity increase the proportionate number of accidents because of the greater activity of the men. What I desire to know is whether there is a greater number of accidents among a greater number of men, or whether it is simply proportionate to the increase.

MR. HUNTER—I took my statistics bodily from the report of the Interstate Commerce Commission of 1899, which ends with June 30, 1900, and this report shows 10 per cent. increase of injuries, there being no reference made about the different numbers employed. The 10 per cent. increase of deaths, and 13 per cent. increase of injuries have nothing to do with the increase of employes. Formerly we were cutting off the hands of railroad employes, but since the advent of the automatic coupler we have been cutting off toes and feet instead of hands.

DR. LACEY—I understand you to say that the increase in deaths and number of injuries is computed irrespective of the number of men employed?

MR. HUNTER—Yes, sir. I take the view of both Dr. Owens and Dr. Cole. I am the responsible head of our legal liability department, and I direct all of our surgeons to save every limb they can; that if it is necessary to cut them off afterwards, they can do so, and it may be necessary to do this.

DR. W. J. MAYO, Rochester, Minn.—There are some points brought out by Dr. Grant in his paper in which I am very much interested, and one is with reference to the medicolegal aspects of the *x*-ray. Should we advise that the courts accept the *x*-ray as true evidence? I think not. The *x*-ray is not a true photograph of the object itself, but rather a silhouette. I think that can be illustrated in this way: We know that it is a common things among young people to hang up a sheet, get the light on one side, and with their hands throw shadows on the sheet, making various kinds of pictures, or silhouettes. I have seen this illustrated very nicely by Dr. Cross in Rochester, who has demonstrated repeatedly the variability by the position in which the *x*-ray plate was placed with regard to the fracture and the tube. The apparatus, tube and light were manipulated so as to make a displacement appear much greater or much less. All these things should be carefully considered. If the *x*-ray is to be accepted in courts as evidence, it is going to cause an endless amount of trouble for physicians and surgeons.

In regard to cutting down upon fractures, in which there is very little or no displacement, I would like to say a word or two in regard to the proper time in which it should be done. If it can be done immediately, it is an exceedingly good time to do it. But in cases in which there has been much external violence and the injured member is covered with blisters and

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to replace properly, the fragments, in which an x-ray picture
has been taken at the request of the attorney or patient, and
have considerable deformity, I think it would be wise to in-
form the patient that the only way to treat his fracture is by
means of an open operation and let him elect whether it shall
be done or not. If he elects to continue treatment without an
open operation he does so on his own responsibility, and the
surgeon is not obliged to carry the entire blame. In this way
we can protect ourselves partially against the x-ray.

Dr. Lewis Schooler, Des Moines, Iowa.—I am an interloper,
and it is hardly fair that I should take up the time of the
Academy. The subject of fractures and the illustrations that
have been shown by the author of this paper illustrate very
forcibly the difference between a functional result and accurate
coaptation of the bony fragments. The x-ray produces the most
difficulty, perhaps, in convincing a patient that there is some-
thing wrong with the coaptation of the ends of the bone if
they are not accurately brought together; he is perfectly satis-
fied with the functional result and gets along very well until
it is forced upon his mind that there is something wrong with
the adjustment of the fragments. I am glad that the last
speaker brought out the fact that the x-ray, like the micro-
scope in the hands of some persons, and the photographing
apparatus in the hands of some operators, can be made to show
almost any condition and it is impossible to tell exactly the
condition and position of the bone. Skiagraphs are made at
any angle in which the x-ray may be placed. They are therefore ab-
solutely misleading. Wherever there is a deformity as great
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amount of adipose tissue whether there is overlapping of the fragments or not, yet we find the *x*-ray showing exactly that condition where it is impossible for us to find it.

The laity are inclined to rely wholly upon the evidences of the *x*-ray machine, but the profession have knowledge of other evidences that are not only equally but decidedly more reliable and can not be superseded by the rays in their present stage of development.

Dr. D. W. Smouse, Des Moines, Iowa—I must take exception to the remarks of my friend Dr. Schooler in reference to the *x*-ray. I do not do much *x*-ray work myself, but I have an assistant who does a considerable amount of it, and I find the work is increasing all the time because there is a demand for it. There is no doubt about the fractures being exaggerated very greatly by the manner in which Crooke's tube is placed and the position the plate is in. The fault lies largely in the bone that is fractured, as well as the splint that is applied to it, and the operator and appliances that are used. This fault can be overcome by the *x*-ray apparatus being placed in the hands of skilled operators only. A certain allowance is to be made for the angle at which the ray is taken. There is not going to be any deviation shown in the skiagraph unless there is some deformity at the time. If the fragments are brought together perfectly, we are not going to get any deviation, and the skiagraph is not going to show an imperfect coaptation where it does not exist. The *x*-ray has been a source of a great deal of satisfaction to me in the last two years in which I have used it. I have first adjusted the fragments, and have then had a skiagraph taken with the fragments in position. If the skiagraph showed perfect apposition of the fragments, all well and good. If it did not, I would readjust the fragments, and then have another skiagraph taken. In this way I have found the *x*-ray of great assistance to me. The *x*-ray is going to force us to do better work in the treatment of fractures and dislocations.

I am glad that Dr. Mayo said the responsibility will have to be thrown upon patients, that is, as to whether treatment shall be continued by the open method, or whether the patient shall accept the best results that can be obtained by the application of splints, by extension, or by whatever apparatus may be applied, or whether he prefers to have a second operation done for the purpose of adjusting the fragments more perfectly.

A word in regard to the medicolegal aspects of the *x*-ray. I think our courts in matters of this kind will do what the medical profession advise in regard to them. This matter has come up in our courts in Iowa two or three times, and the judges have invariably sought the opinions of the best surgeons as to what they thought of it. If they think it is of no

importance, the judges will accept their opinions, and will exclude it as evidence. That is about the situation of the *x*-ray at the present time, so far as I can judge.

DR. GRANT (closing the discussion)—I do not care to say much more in reference to this subject. Its value is not altogether, as I stated, in fractures from a diagnostic point of view: but it may enable us to determine approximately the extent of a displacement. Dr. Smouse tells us that he readjusts the fragments with every picture he takes, if they are not in accurate apposition. So far as my experience goes, this readjustment will have to be continued quite constantly until nature has settled the matter by bony union.

In reference to fractures of joints, I know of no means short of fixation and the operation which I have mentioned that will maintain accurate adjustment and coaptation of the fragments. The angle of deflection of the plate in the skiagraph and the distance are to be considered. Even then it is impossible to properly interpret the condition of the parts without an accurate knowledge of anatomy, and the scientific use of skiagraphs depends very largely upon the interpretation of the *x*-ray shadows. While we fully understand and appreciate the uncertainties of the *x*-ray, it has been admitted in many of our courts throughout the country. Courts do not rely exclusively upon it as evidence. The *x*-ray is often admitted as evidence to the great injustice of surgeons, notwithstanding the universal opinion of the profession that a photograph of a shadow is absolutely unreliable, so far as accurate information is concerned, as to a broken bone or a displacement. The National Association of Railway Surgeons passed a resolution at its last meeting which will have some influence with the courts, and in substance it says that it is unsafe to use it as evidence because a skiagraph is not a real picture of the object, but of the shadow of the object. A skiagraph sometimes does not show a fracture to exist unless there is great overlapping of the fragments, and also seems to show one where none exists. It is surprising to note how much better the functional results are in many of these cases than indicated by the *x*-ray, for instance, in the broken bone of the thigh of the girl. The case in which there was an extreme angle was examined by another surgeon and myself, and we could not under any form of measurement obtain over three-quarters of an inch of shortening, and reported the case as a good average result. I told the patient that the only way it could be improved was to cut down on it and wire it, though the result was very good as it was. The external contour of the leg is excellent, and the position is good, but these skiagraphs make the leg appear much worse than it really is.

HOW TO TREAT MUSCULAR AND JOINT SPRAINS OF RAILWAY EMPLOYEES.

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CHIEF SURGEON, CHICAGO GREAT WESTERN R. R.
ST. PAUL, MINN.

Joint and muscular sprains differ, so far as I know, not the slightest from the same affections in other occupations, but the same justification that obtains in calling railway surgery a special branch of surgery will allow of the use of the title of this paper. Sprain of some sort or another is a very common accident among railway employees. This is perhaps due to the fact that so many of them, in the discharge of their duties, are forced to run backward and forward, work on machinery in constrained positions, do heavy lifting, and are exposed to falls from heights. In order to form an idea of how frequently such accidents affect railway employees, I have prepared a table of the sprains and strains of all kinds, reported as such to my office, occurring on the lines of the Chicago Great Western for the year 1899:

SPRAINS AND STRAINS OF CHICAGO GREAT WESTERN R. R. EMPLOYEES, 1899.

Firemen.

CHARACTER OF INJURY.	No.	CAUSE OF INJURY.	No.
Thumb	2	Falling down	17
Wrist	4	Shaking grates	3
Shoulder	4	Muscular exertion	3
Lumbar	5	Collision	1
Foot and ankle	2		
Knee	2		
Hip and thigh	3		
Forearm	1		
Side	1		
	24		24

Brakemen

	No.		No.
Shoulder	2	Arm twisted	1
Knee	2	Muscular exertion	1
Arm	1	Falling	7
Elbow	1	Turning foot	2
Foot and ankle	5	Lifting	2
Lumbar	2	Collision	1
	14		14

Engineers.

	No.		No.
Lumbar	5	Switching	1
Wrists	2	Wreck	1
Leg	1	Falls	5
Elbow	1	Arm Caught	1
Thumb	1	Collision	1
		Tank tipped	1
	10		10

Section Hands.

	No.		No.
Inguinal region	1	Struck stove	1
Foot and ankle	2	Falls	4
Abdominal muscles	1	Collision	2
Wrists	3	Turned foot	1
Knee	1	Lifting	2
Neck	2		
	10		10

Miscellaneous.

	No.		No.
Knee	2	Falls	18
Wrist	6	Muscular exertion	2
Side	2	Scuffling	1
Ankle and foot	13	Caught foot	4
Lumbar	6	Lifting	2
Leg	2	Turning foot	5
Finger	1		
	32		32

It will be seen from the table that, as far as occupation is concerned, the greatest number injured, strangely enough, were firemen, to the number of 24.

We would have expected *a priori* that the number of sprains would have been greatest in the brakemen, who are continually climbing over cars and running backward and forward along the train, but the number of these so injured was only 14. Next were engineers and section hands, 10 each, and finally all other occupations, such as boilermakers, machinists, wipers, carpenters, etc., to the number of 32, making a total of 90 cases reported to my office as sprains or strains, out of a total of 622

accidents for the year 1899. The percentage of sprains and strains to the total is 14.45.

The character of injury in all these cases has been sprains or strains of fingers, wrist-joints, shoulder-joints, foot and ankle, knee, hip and thigh, arm, back and side. By far the largest number of sprains reported were of the ankle and foot, 22 cases out of 90. Wrists were sprained 15 times. In all the cases of strains, by far the greatest number were of the back, or, as I have tabulated it, of the lumbar region, a total of 18 cases. It appears that engineers hurt their backs, brakemen their ankles, while the firemen sprain backs, wrists and shoulders indifferently.

The cause of injury shows a preponderating number due to slipping and falling, resulting in injuries to the wrists and ankles especially. The total number of cases due to falling is 51. Various sorts of muscular strains resulting from muscular exertion were present in 9 cases.

The percentage of sprains and strains in a total of 622 cases being 14.45, these are therefore frequent accidents among railway employees, and six years of experience in railroad work leads me to believe that these are precisely the injuries which lay up the employees the greatest length of time, and the object of this paper is to show how the time of recovery can be shortened, in my opinion at least 50 per cent.

What do we mean by sprain? The definition of Dr. Douglas Graham is a very good one: "A sprain is a sudden partial displacement of two joint surfaces followed by immediate replacement." A strain is a stretching of the tissues beyond their normal limits, resulting in rupture of some of the tissue elements. These strains may affect any of the tissues, but do not, in my opinion, ever occur in ligaments.

Dr. P. S. Conner, Cincinnati, teaches that ligaments are made up of white fibrous tissue which is absolutely

inelastic, and therefore can not stretch; at the same time it is so strong that it is easier to pull it from its attachments in bone or muscle—tendon—than to rupture it. A writer in Gerrish's Anatomy says that a little reflection will teach us that if tendon could stretch then our muscular efforts would be wasted on the elasticity of the medium between muscle and bone. Morris' Anatomy also teaches that white fibrous tissue is incapable of stretching. I mention this particularly because the term "stretching of the ligaments," especially as applied to the ankle-joint, is used so frequently and so loosely. In a very few instances postmortems after injuries of joints have been made which would seem to indicate that ligaments can rupture, but experimental work has shown that it is easier to pull off a scale of bone at the attachment of the ligament than to rupture the ligament, i. e., in ligaments other than thin fascial expansions, and I believe, owing to the absence of elasticity in the ligament and its great strength, that such accidents as rupture almost never occur. Therefore, when surgical writers speak of stretching and rupturing ligaments it means one of two things: the stretching and rupturing of connective tissue, the areolar tissue, blood vessels, etc., or it means the tearing off of a scale of bone at the attachment of the ligament involved. The last is what generally occurs in very severe sprains of joints. So much for the pathology.

TREATMENT.

From the earliest times war has been waged as to what constitutes the proper treatment of a sprain, especially as regards sprains of the ankle-joint. On the one hand, there have been those who contend that what a joint needs after an injury is rest, and the more absolute this rest can be made the quicker recovery ensues. The adherents of this idea elevate the limb affected, put it up in immovable dressings, and wait around until the rest and dressings have resulted in the disappearance of

swelling, which requires from fifteen days to three months; then the patient is requested to walk around and use his leg so as to make it strong again. If the patient has been laid up two or three months he finds himself unable to follow the surgeon's advice, as his limb is weak and walking painful and difficult. What has occurred? We know that immobility of a joint induces passive inflammatory changes, leads to the disappearance of the synovial fluid and roughening and thickening within the joint. On the muscles this so-called rest cure has produced atrophy and possibly contraction. The fat and other tissues forming the pads around the ligaments and tendons have been absorbed, and we find a preternatural immobility in our joint.

Adherents of immediate motion apply bandages or adhesive plasters and encourage their patients to get around immediately after the injury. At the present time there is a large class who endeavor to skim off the cream of both contentions. They keep their patients perfectly quiet for a few days with immovable dressings, and then advise massage and motion. The results have been much better, as regards the time required for recovery and the strength of the limb, with the last-mentioned treatment, than with the so-called absolute rest treatment.

To have a correct idea of how to handle these cases in order to promote speedy recovery, we should bear in mind the few points I cited regarding the pathology and, further, the surgical indications. There are perhaps very few sprains of the joints which are not accompanied by contusion of the joint surfaces. The tearing of the areolar tissue and the rupture of the small blood-vessels, results in a rapid, painful exudative swelling and discoloration, for which the first surgical indication is rest, but the question immediately arises: What is rest for these involved tissues? Ranke rinsed out the vessels of fatigued muscles with a normal saline solution, which

[illegible] restored them to full vigor: the experiments of Zaudowski have shown that muscles exhausted by faradization could be restored at once by massage. Mazzoni showed that massage of muscles fatigued by mechanical labor quickly restored them to normal function. What do these experiments mean? They mean that the muscles are constantly functionating, even when a limb is immobilized: the muscles are in a state of tonic contraction, and fatigue simply means a heaping up of the waste products resulting from the work of the muscle cells, such as lactic acid, creatin, carbonic acid, acid phosphates, and perhaps toxins, and *rest for muscle means the getting rid of these waste products and the furnishing of new oxygen and new food from the blood.* We know that immobilization produces atrophy and contraction of the muscles, and knowing what the physiology of muscular rest is, it must be plain to every one of us that rest does not mean to confine a limb in a dressing which does not permit of motion of the muscles. On the contrary, rest for the inflamed, contused, torn and otherwise involved tissues does mean immobilization. The next indication to be made is the antiphlogistic one. How can we limit excessive leucocytosis and inflammatory exudation? The application of cold water and evaporating lotions fulfils these indications. In cases where there has occurred a rupture of the attachment of the tendon or ligament with its scale of bone, practically a fracture, an indication arises for the maintenance of a proper position in order to allow of union. Now, how are we to fulfil all these indications for treatment, some of them which seem paradoxical, i. e., both motion and immobilization? The muscles involved in every sprain should have motion all the time in order to allow muscular contraction to exert its pump action on the lymph vessels which carry away waste products whose presence produces fatigue and pathologic changes.

The contused joint surfaces should at the same time be immobilized, providing the contusion and laceration is very severe. The index to the severity of such an injury will be found in the amount of pain and nausea experienced, and the amount of swelling. Discoloration of the skin is not an index of the amount of injury. We can elevate the limb affected, apply a wet cheese-cloth to the swollen joint, and over this an ice-bag during the first few hours or days until we attain to the height of the inflammatory process resulting from the trauma. Motion can at the same time be administered to the muscles passively, by means of massage, which produces for these purposes precisely the same changes as active muscular action, and besides carries away the waste and inflammatory product in the lymph and venous blood. In all sprains of moderate severity both massage and active use of the limb can be instituted immediately or after a few hours.

In a case of the ankle we should apply an elastic cotton bandage firmly to the limb, or leave on the shoe in the case of the ankle, lacing it up, and encourage our patient to walk the sprain away. On retiring, the patient can have massage treatments, and hot applications or a local wet pack. The massage should be begun as soon as possible after the injury. It should be administered by a skilled masseur and should consist of centripetal strokings and kneadings, and extremely light frictions and strokings over the inflamed area, the last being designed to favor the centripetal circulation and the spreading out of waste products in the tissues so that they can be the more easily absorbed by the lymphatics.

After the acute symptoms have subsided, hot applications are the best because they dilate the superficial vessels and promote local circulation, which assists in carrying away the inflammatory products. Since fractures or displacements frequently occur in the region

of the ankle-joint, and as the inflammatory symptoms are usually more severe in these cases, we will at times be forced to keep our patient quiet for several days, using ice-bags and massage, before we can put on the bandage or Gibney's plaster bandages, and put the patient on his feet. It is astonishing to the surgeon how quickly the patient can get over the sprain, if compression be put on the joint and the patient receives massage and gets about. I know a recent case where the plaster dressings and rest were used in a sprain of the ankle and foot, where two years and six months were required to put the patient on his feet without crutches and appliances at his ankle, and I feel sure that had this patient been treated properly along the lines mentioned in this paper, only a few months would have been required at the utmost. As it was he was in almost useless condition at the end of two years and three months. The muscles of his leg were atrophied, there was too much motion at the ankle-joint, and the patient was fearful of putting his weight on his leg, and complained of getting tired quickly, and of pain in the whole limb. Systematic massage, use and encouragement sufficed in a short time to remove all this disability. In these old cases, besides the measures referred to, the use of the Scottish douche is good, that is, hot and cold water applied alternately. It is of great value in promoting recovery. Swedish gymnastics, in the shape of active and passive movements of all the joints of the limb affected should be used, in conjunction with other measures. In the vast majority of sprains of the ankle, the ambulatory treatment is very satisfactory. The average time required for recovery will be from six to twelve days. In 400 cases it was nine days. (Douglas Graham.)

A muscular strain of considerable severity will show to the palpating finger an elevation of ruptured muscular fibers. In these cases a little gentle massage will

promote speedy recovery. In a vast majority of so-called muscular strains, there will be no elevation to be felt by the palpating finger, and in these cases the cold douche, and static electricity both for its local and mental effect, gives remarkable recoveries.

To recapitulate: 1. Ligaments are rarely if ever torn in so-called sprains, and are never stretched. 2. The pathology in the majority of sprains is a rupture of the areolar and connective tissue around the joint, and a contusion of the lining of the joints. 3. Immobilization of muscles is not rest. On the contrary, in all sprains the muscles should have passive exercise the first few hours, and days, and active exercise after that. In the majority of cases active exercise should be instituted from the beginning. 4. The plaster casts should not be used at all, even in cases where we have a fracture, unless it be impossible to maintain a proper position of the joint. 5. Hydrotherapy in the shape of ice applied over a wet cloth the first few hours; water in the shape of hot fomentations or in the shape of the Scottish douche, where we wish a stimulation, is of very great value. 6. The counter-irritation of static electricity in conjunction with massage is the best treatment for a strain. 7. The ambulatory treatment of sprains in conjunction with massage is to-day the best treatment.

DISCUSSION.

Dr. F. A. Butler, Harvard, Nebraska—I do not know that anything of interest can be added to the doctor's elaborate and scientific paper. He seems to have covered the ground very well. In the treatment of severe sprains of muscles or joints, cold applications continued as advised often prove very beneficial, but cold continued applications are not agreeable to all alike. Where we meet with such a patient, hot applications continued may be agreeable and beneficial. Medicated solutions, either hot or cold, may be timely. Whichever of these methods is adopted must be persisted in. Massage is a very useful adjunct in the treatment of sprains, using the upward stroke with a deft hand, from below upwards, diminishes tenderness, presses away irritating secretions into other

[illegible] portions of the connective tissues, thus more [illegible] properly and judiciously [illegible] the treatment of a certain percentage of these cases. In the main, treatment must be directed [illegible] subdue the inflammation. Pain must be treated, with the ultimate idea in view of restoring the proper function of muscle or joint affected, and whatever the plan of treatment we may adopt, it must be persisted in to secure satisfactory results. If we are to blame in the treatment of sprains, it is because treatment is discontinued too soon. No [illegible] those receiving sprains simulate largely a rheumatic or hysteric tendency. In consequence of this, and leaving off the treatment too soon, we receive more censure at the hands of this class of patients than any other. It is because we have failed to treat them properly, and have not kept them under our direct supervision long enough to secure a good result: we have turned them over to a nurse or somebody else, who has failed to follow our directions. We should see to it that our directions are carried out implicitly and absolutely until the patient is all right. In a mild injury of this character, a tight, snug-fitting bandage may afford permanent relief at once, but in cases that are at all severe, complete rest in the recumbent posture is absolutely necessary if we hope to bring about a speedy and satisfactory result. In the treatment there are several leading indications to be met: 1. secure complete rest to injured muscles or joints; 2. subdue inflammation; 3. relieve pain; 4. restore the proper function, which is often difficult to accomplish. Pain, tenderness, swelling and stiffness that so commonly follow a severe sprain of a joint are the principal impediments to its free use, and if it is not overcome at time of receiving the injury, the joint may remain weak and troublesome for a lifetime.

Dr. J. T. Eskridge, Denver, Colorado—I would like to call attention to two of the essayist's postulates: 1. that rest of a muscle necessarily means wasting, and 2. that the wasting of muscles occurring from joint trouble is due to inactivity of the muscles. We know very well that in hysteria a patient may be paralyzed for several weeks, months, or even years, and the muscular atrophy may be almost imperceptible. That it is not the inactivity of the muscle that principally gives rise to atrophy, following joint troubles, has been demonstrated by Dr. Raymond, of Paris. Observing that muscular wasting took place, especially involving the extensor muscles, in rheumatism and other diseases or injuries of the joints, Dr. Raymond instituted a series of investigations to determine the pathology of muscular wasting resulting from injuries or diseases of the joints, especially attended by pain. He found

that the muscular wasting resulting from affections of the joint was not attended by any of the reactions of degeneration. On the contrary, where there was irritability of the muscles, contraction often occurring to a smaller quantity of electricity than is found to take place in health. He noticed, also, that it was principally the extensor muscle of the joint that atrophied. He then experimented upon animals. After injuring the joints he observed profound muscular atrophy occurred, notwithstanding that the muscles were massée d and electricity applied. He then cut the motor nerves to the injured joint, and the result was that muscular atrophy still occurred. Then he took other animals and divided the sensory nerves of the mutilated joint, and the result was almost no wasting of the muscles. These experiments demonstrated that the muscular atrophy resulting from joint troubles are due to inhibition, caused by the pain in the joint, and not from the inactivity of the muscles. The suggestion that we derive from Dr. Raymond in the treatment of joint troubles is, for the physician to relieve the pain of the joint as soon as possible.

Dr. J. P. Lord, Omaha, Nebraska—I agree in the main with nearly everything that was mentioned in the paper, but it is difficult to formulate hard and fast rules for our guidance, and it is necessary to temper all methods of treatment with considerable judgment. The doctor alluded to such cases as are under the immediate supervision of the surgeon, and of course in this class of cases he can determine whether the active treatment of the condition is going to be successful or not, and know whether he is going to get a synovitis or arthritis of the joint subsequently. But many of these sprains come to us that have not had any treatment at all, and we find that they have developed either a synovitis or arthritis, with considerable effusion in the joint, or a thickening, a condition which gives us considerable concern and requires many months of treatment to attain ultimate success. If it were to become generally understood that the best treatment for a sprain is the use of the limb—and the laity are quick to adopt our ideas—in many instances there would necessarily result considerable harm, and we would perhaps see more of the ill results of the active treatment, so that it is necessary to keep this class of cases under continual observation to carry that treatment out. In a given case it is impossible to know whether certain of the internal structures of the joint have been materially injured or not, and it becomes necessary to exercise considerable wisdom. I find that when these cases come to us, after a few days, in which the active treatment has been carried out to a great extent, the rest spoken of is absolutely essential. We have to allay the acute process, just as we have to prevent it at the start, by rest. We should in-

stitute such treatment as will best enable the injured member to resume its function.

It has been the experience of all of us that there has been too much immobilization. When we get extensive effusion of a joint and a lengthening of the ligaments, which we often find in this class of cases, we may well ask ourselves how this lengthening of the ligaments takes place. It certainly does occur, and we have a very complex condition. To relieve the effusion, to reduce the thickening, the most speedy results can be obtained by the administration of iodid of potash, and the best means of correcting the overstretched condition of the ligaments is to get rid of the effusion quickly, in some instances by aspiration, and then apply a mechanical support to give rest to the lengthened ligaments: whether they have been stretched, or whether in this overdistention of the joint there has been sufficient reproduction to produce this lengthening of the ligaments, is a point which I am unable to fathom. We know that it does exist; as orthopedists we encounter elongated ligaments which occur by a slow process. It would be interesting to know how much comes about by stretching or by reproduction.

Dr. William H. German, Morgan Park, Illinois—I would like to call attention to the method of treating sprains of the ankle joint described by Dr. V. P. Gibney, of New York. During the last five years I have treated ankle sprains with rubber adhesive strips, beginning at the metatarsal articulation on the inside of the foot, bringing the strip horizontally around the heel to a corresponding point on the outside of the foot; then with a similar strip applied vertically and brought under the foot and to a corresponding point on the inside of the leg, alternating these strips until the whole joint is included, and covering the whole with a cheese-cloth bandage. This method allows the patient to move around and permits motion which is not inconsistent with rest of the muscles, and produces quicker and better results than anything else I have tried.

Dr. Sneve (closing the discussion)—In regard to the remarks of Dr. Butler about the use of water, namely, that some patients like warm water while others like cold, I will say that there are definite indications for the use of hot and cold water. The use of cold water in the beginning, after trauma, is designed to be antiphlogistic; but to limit the amount of swelling, to cause contraction of the blood vessels, this cold must be continuous. In order to do that easily in our practice, we should have an ice-bag, or ice in some form should be put over a cloth which is wet, which will allow easy conduction, and which will keep the tissues much colder than if the ice is applied as a dry ice-bag. The use of hot

water, on the contrary, is to promote resorption, to act as a stimulant, and is a very good thing to use. I think the indications are quite definite for its use after the principal exudative effects of the trauma have taken place. The use of alternating hot and cold applications is valuable because of the great stimulating effect upon the circulation locally.

In regard to the remarks of Dr. Eskridge about the wasting of muscles not being due to disuse, the experience of all surgeons with atrophy from disuse ought almost to refute the experiments of Raymond, which have not been shown to be conclusive by other observers. If the muscle wastes because the inhibitory influence is gone, how are we to explain the loss of inhibitory influence where there is no paralysis, where the motor nerve is all right, where there is a simple contusion of the tissues, or frequently very little contusion except in the interior of the joint? How are we to explain the numerous experiments that have been made along this line? The atrophy that always occurs when a limb is immobilized? As regards hysteria, we know so little about its pathology that it is difficult to draw conclusions. Hysteric subjects go on for a long time with complete monoplegia or complete paraplegia; but these limbs are moved around considerably, so that they get more or less exercise of their muscles.

So far as lengthening of the ligaments is concerned, I know nothing regarding the facts cited by Dr. Lord. What has forcibly appealed to me is the fact that it is not due to a stretching of the ligaments that we get preternatural mobility of a joint after a sprain, but that it is probably due in a measure to immobilization of the muscles, because there is loss of function, a weakening and atrophy quantitatively, and the muscles do not hold the joint surfaces together as well: and perhaps the main factor is that there has been absorption of the connective tissue round about the ligaments and joints forming the supports. These cases soon lose the apparent shortening after proper treatment. In cases where we can twist the ankle to one side, where we say we have a tremendous preternatural mobility, we say the ligaments have been stretched; but if it be true that we can not stretch the ligaments and these patients soon recover after receiving proper treatment, we can not but think it must be due to some other factor than lengthening of the ligaments.

With reference to the use of Gibney's method of treating ankle sprains by the application of adhesive plaster, I mentioned it in my paper. It is a good treatment. I have used it. It is a good way of applying pressure and support, and gives the patient, besides the necessary local support, a mental support, so to speak, to encourage him to walk on his foot. I have personally walked after a severe sprain: I did not

even have massage. My joint was very painful at first, but it is wonderful how the pain will disappear if walking is kept up.

I did not attempt to lay down absolute rules for our guidance in the treatment of these cases of ankle sprains, because each case is a law unto itself. I simply called your attention to certain principles which should govern our treatment of this class of cases. The treatment of these cases of ankle sprains in the past has been a reproach to the medical profession when viewed from the standpoint of massage. Massage establishments, bone-setters and osteopaths have cured many of these cases where physicians have puttered along with the application of plaster-of-paris, because they have made use of the muscles.

ELBOW FRACTURES AND THE X-RAY.

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There are, no doubt, those who think we have reached the highest excellence in the treatment of most fractures, but none who are familiar with the treatment and results of elbow fractures and *x*-ray disclosures will be deluded by the brilliant achievements of this surgical age. There are still more things in surgery and medicine than are dreamt of in our philosophy. My purpose is to present for consideration some mooted questions in the treatment of these elbow injuries and the importance of the facts disclosed by the *x*-ray in the future treatment of fractures.

Allis, years ago, called attention to the importance of maintaining the normal angle of the humerus and ulna in the treatment of fractures of the lower end of the humerus, because of its influence on the carrying function of the arm. He treats the arm in extension because he believes it best maintains the fragments and the normal angle. This angle is greater than many suspect. With the arm extended in supination, a line drawn from the head of the humerus between the tuberosities will meet a transverse line through the carpus two inches inside of the styloid process of the ulna, which is the measure of the outward deviation of the forearm. If, in the adjustment of the fragments, the articular surfaces do not conform to this angle, the

carrying power will be diminished. In any position with imperfect coaptation of fragments anchylosis is more certain. The assertion of Stimson that upward displacement of the internal condyle one-fourth of an inch will destroy the normal angle of deflection at the

Case 1.—Supracondyloid fracture of right humerus.

elbow is in itself a strong plea for more radical and reliable treatment in many of these cases.

The maintenance of perfect coaptation of the fragments is not only difficult, but almost impossible without cutting down on the fragments and fixing them by wire

or screws or clamp. The great majoritv of surgeons treat fractures of the condyles and supracondyloid with the arm at a right or acute angle. A few, conspicuously Allis and Roberts, prefer the arm in complete extension, believing that anchylosis is not so common. I have not treated these fractures in extension nor by operation, except compound, but I have seen more cases of anchylosis in this than in the flexed position.

Unlike most fractures, a perfectly accurate adjustment and coaptation of the fragments seem necessary to a perfect functional result. This object is so difficult of attainment that if more satisfactory and perfect results can be safely obtained by operative means the time has come when it should be more generally adopted.

I have two cases, with skiagraphs, which I desire to report as pertinent to the discussion.

Mrs. M., aged 65, fell on the sidewalk in May, 1898, producing a supracondyloid fracture of the humerus. The line of fracture, as shown by the skiagraph, traversed the upper border of the coronoid and olecranon fossæ. It did not seem difficult to replace and to maintain the fragments. The two skiagrams taken on the second and seventh day show that the fragments were not retained in as good position as desired. There was splintering of the upper fragment posteriorly. The fragments were adjusted three times and the arm kept at a right angle in long posterior and short anterior splints. While flexion and extension are not perfect, the functional result is good. The fact that she can feed herself and dress her hair with ease is sufficient attestation of the fact. She experiences no discomfort nor inconvenience in its use. It is difficult to prevent rotation of the lower fragment in these cases.

Except with a laboring person, the evil of the gunstock position as to the impairment of the carrying function is much exaggerated.

Union, with as much overlapping as indicated, is a

mechanical impediment to perfect flexion. Cheyne and Burghard suggest that this defect may be overcome by treating the arm in acute flexion with a compress over the upper fragment. As most surgeons believe that the action of triceps and brachialis influences the position of the lower fragment, I may suggest that as no position will relax both, tenotomy is appropriate and sometimes useful.

Case 1.—Mrs. M., October, 1900, three years and three months after injury. Arm looks well. Considerable antero-posterior thickening due to splintering, callus and undue prominence of upper fragment anteriorly with rotation of trochlea.

Case 2.—M. M. Y., aged 40, a brakeman, was, on June 21, 1900, on top of a refrigerator car with his legs in the ice chamber when the car went off the track and, throwing him against the side of the ice chamber, fractured the internal condyle of the left humerus, involving the joint freely. I saw him twelve hours after, when

the parts were greatly swollen, making a satisfactory examination difficult even under chloroform. Four days later a skiagraph by Dr. Stover showed the fragments with the condyle displaced upward. The swelling was now much reduced, and under chloroform the fragment was easily adjusted and the arm treated at a right angle throughout. It was examined two or three times a week, but passive motion was not used until the end of the third week when union was quite good. At the end of two months he was engaged in light work and flexion and extension were very good and steadily improving. A skiagraph three months later, September 19, showed good union and excellent position of the fragments.

Some recent writers maintain that the coaptation of the condyles can only be securely maintained by cutting down on the condyles and wiring or nailing the fragments, and that this is the best method of treatment, while most surgeons would treat them with bandages and splints in flexion, a few in extension.

There are some general considerations of special interest that might with propriety be mentioned in this connection as determining general conclusions:

Anchylosis is due to misplaced fragments, and when in position should not be endangered by manipulation. Rubbing and gentle massage of the muscles may be used in a week. It is important in feeble subjects, but care should be exercised not to disturb the joint and fragments, as rest is the important principle in the treatment of any fracture and of the greatest value in acute joint troubles.

The real status of the *x*-ray is yet to be determined, though its use in surgery is one of the distinct scientific advances of our time. I fear we are prone to rely too exclusively on instruments of real or supposed demonstrable scientific precision which do not appeal to the exercise of our own analytic judgment and surgical acumen. There is danger that improvements in speciali-

zation may dull our sensibilities and, to an unfortunate extent, limit our accomplishments in methods of investigation and diagnosis. In the location of foreign bodies its value is unquestioned. In the diagnosis of fractures its use is not so important nor its benefits so pronounced. In demonstrating the position of the fragments it is more useful, yet often inaccurate, and therefore unreliable, and dangerous to the surgeon because it exaggerates the malposition of the fragments, the deformity and the

Case 1.—Miss M., October, 1906, three years and three months after injury. Longer exposure in x-ray. Callus not so well shown. Shift valve. Functional result very good.

impairment of the limb. The functional results are much better than the skiagram would indicate as possible. This is well illustrated in the skiagram presented of an oblique fracture of the femur in a child 9 years old. The accident occurred April 21, 1906, by the child falling from a mine shaft. One month later she was placed in my charge, and at that time the skiagraph

was taken. Repeated and careful measurements showed that the shortening did not exceed three-fourths of an inch, and this was partly due to the bend or distorted axis of the limb. I call attention to the apparent extreme overlapping of the fragments. The light shadow represents the temporary callus. The distinction is highly important. Imagine the influence of such a picture on a patient or a jury. As the father in this case expressed it in a letter to me: "It was about as bad a jumbled up leg" as he ever saw. It might have been better, but the functional result is good. She was treated by an intelligent young surgeon who noted great difficulty in controlling the child's movements and the position of the limb, though it is quite natural and, to all external appearances, the result is excellent.

The other skiagraph, made by Stover, of Denver, one year ago, represents an oblique fracture of both the tibia and fibula about the middle. It is the case of a Boston woman who was treated by a Boston surgeon. It is a unique and extremely interesting specimen and appropriate to this discussion. It will be observed that while the tibial fragments are not perfectly adjusted, yet union is good; but the chief interest is in the fibula. The upper end of the lower fragment was undoubtedly driven against the tibia when the accident occurred, was never replaced, and is united to the tibial fragments, while the upper fragment is not in contact with any other, and therefore is ununited. The contour of the leg is perfect and the patient uses it even in dancing with comfort and pleasure. The position looks bad, but I believe it a safe assertion that the fragment could never have been replaced without cutting down on it and adjusting by the application of force.

Such a demonstration is significant. Mr. Lane,[1] of London, maintained, with much plausibility, that mus-

1. Lane Lectures, 1897.

cular action in displacing and preventing the satisfactory adjustment of fractures is greatly overestimated by surgeons: "That spasmodic muscular contraction exerts no appreciable influence on the fragments and may be

Case 2.—M. M. Y., posterior view June 23, fourth day. Readjusted immediately after.

left out of consideration in the treatment; that at best its opposition to replacement in the early period is only slight and transitory; that the obstacles to perfect adjustment are effusion of blood and inflammatory pro-

ducts about the fragments, and that we are unable to restore the bones to their normal form by means of manipulation and splints." While these remarks are specially applicable to Pott's fracture and to oblique fractures of the long bones, and, I may add, to the lower jaw, it will be a distinct advance when operation is resorted to when the fragments can not be satisfactorily adjusted and maintained by other means. In com-

Case 2.—M. M. Y., September 19, three months after injury. Good union and position of fragment.

pound fractures there should be no ground for controversy. In others the question has only excited serious general consideration in reference to fracture of the patella, and the great majority of surgeons prefer non-operative methods. But if worthy of serious notice concerning a fracture that frequently involves an important joint, what serious objection can be used to its

application in fractures which never involve a joint, and where, should infection occur, it is not likely to prove so serious. Infection is the only danger, but with confidence in the established tenets of modern surgery in reference to bacteriology we do not hesitate to expose the abdominal and every other cavity with impunity, and why not broken bones.

Fracture of both bones of leg. Note symmetry of fleshy outline.

With due allowance for its defects and dangers, the x-ray has made new conditions and imposed new demands and responsibilities on the surgeon. Do not the medicolegal aspects of the question, as well as practical results, indicate the necessity or desirability of more radical methods in the treatment of certain oblique and

Fracture of Thigh. Posterior View.

joint fractures? If both are put on a sounder and safer basis, this must be answered in the affirmative.

The only way to more certainly maintain the accurate coaptation of the fragments is to immobilize them by silver wire, screw, nail or clamp, but only under the most approved aseptic conditions. In the absence of infection the results must be better. This department of surgery has not been met with the courage and skill that has been so manifest in other fields, and it is too important not to receive the serious attention it deserves.

Carl Beck[2] says, in reference to skiagraphs, that there are injuries, the correct interpretation of which presupposes, besides thorough anatomic knowledge, the greatest care and a vast amount of experience as to the different modes of delineation in various projection planes.

The greatest diagnostic difficulties are offered by the joints. With a distinct skiagraphic plate, taken under improved scientific conditions, it should, he avers, with expert clinical and anatomic knowledge, be evidence in court.

The *Annals of Surgery* for August contains an elaborate scientific paper by Cotton, of Boston, on the "Pathology of Fractures of Lower End of Radius." In reference to the Roentgen ray, he says: "It may be said in advance that there seems to be no single form of lesion described from any actual specimen which is susceptible of demonstration in the shadow picture that has not been demonstrated in one or more clinical cases; nor has the *x*-ray discovered any previously undescribed lesion. . . . It needs no argument to show that the *x*-ray plate, valuable as it is, is in many ways rather an imperfect record."

The American Surgical Association, at its last annual

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2. Med. Record, N. Y., Aug. 25, 1900.

meeting, in May, by unanimous vote passed a resolution that the skiagraph is inadmissible as evidence in court, because, being a picture of a shadow and not of the object, it is inaccurate and unreliable.

The only tenable conclusion, it seems to me, is that the skiagraph should never be used as the determining factor in regard to the existence and pathology of fractures, but may be, in honest and capable surgical hands only, used to supplement or confirm opinions reached without it. It must always be a condition that the electrician is equally honest and competent. The illustrations and facts familiar to surgeons show beyond a doubt how unjust and indefensible a conclusion must be, in or out of court, that is based solely or chiefly on the appearances of the skiagraph.

OPEN TREATMENT OF SUPPURATION OF THE KNEE-JOINT.

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In the January, 1895, issue of the *Annals of Surgery*, Dr. C. H. Mayo reported a case of acute suppuration of the knee-joint, which he had treated July 30, 1894, by a transverse incision across the front of the joint in the same manner as for excision. This enables the surgeon to get at every part of the joint, converting its many recesses into a simple open cavity. The result of the operation is astonishing. In a few hours a patient in whom an amputation seemed to be the only hope is on the road to recovery; such a procedure gives all the benefits of the mutilating operation without shock or injury to important structures. It must be understood that this method of treatment is for the more advanced cases after the usual measures have been exhausted and amputation appears to be necessary. In most instances the capsule has been perforated and the soft parts above and below the joint are infiltrated with septic material. All of the important structures are in the popliteal space, and a transverse incision through the patella enables the surgeon to pack the joint with gauze, and treat it as an open wound. By going through the patella, secondary sutures are given a firm support after the infection is under control. The abscesses, if they exist in the soft parts, are freely opened and drained. The margins of

the wound granulate rapidly and in from two to three weeks, when the discharge has practically ceased, the cut patella is reunited, the excess of granulations removed and the soft parts allowed to granulate.

Surprising to relate, not all of the cases are followed by ankylosis. If the cartilage of the joint is not eroded considerable motion may be ultimately obtained, although this is a secondary consideration, as the condition is one which threatens life or limb. The reason ankylosis does not always follow is because the adhesions are developed in the same manner as a pannus projects over the cornea and, unless the cartilage is completely covered by the advancing granulation, the portion which remains smooth permits of motion. If erosion of the cartilage has taken place ankylosis will necessarily result no matter what method of treatment is followed.

For the milder cases in which the capsule is intact irrigation with antiseptic solutions or with pure carbolic acid followed by alcohol, as advocated by Phelps, is often all that is necessary. If this fails, lateral incisions, as practiced by Halsted, or tubular drains after the plan of Edmund Andrews, may be sufficient, but there are still a number of neglected cases, especially punctured wounds, in which these ordinarily satisfactory methods are entirely inadequate and the patients have in the past come to amputation or death. Open treatment by transverse incision across the entire front and lateral aspects of the joint gives all of the benefits of amputation without its risks, and saves for the victim a most useful limb. We have practiced this method for six years in a number of cases with the most satisfactory results, and in children have obtained a range of motion from 15 to 60 per cent. of the normal. In conclusion I can not do better than to cite Dr. Arpad Gerster,[1] who says that Dr. C. H. Mayo's suggestion struck him as very plausible, and he has "applied it in two cases. The result has been excellent. As all know, these acute forms of joint phlegmon

necessarily end in ankylosis, if, indeed, they do not cause loss of limb or life. The cartilaginous covering of the bones forming the joint is destroyed and, therefore, ankylosis is inevitable. Knowing this fact, the surgeon in adopting this method of treatment frankly accepts the necessity for ankylosis. The road then becomes very clear. The treatment consists in laying the joint open by a transverse incision, extending from one condyle to the other, just as a joint is laid open for resection. Then as many more incisions are made as may be necessary, in order to open up every collection of pus or fluid in or about the joint. The capsule in all of these cases is very intumescent and swollen and for this reason occludes all drainage tubes in a way to make retention inevitable. Then lay the joint freely open, removing or not removing tissues, as the case may be, pack and drain every recess, and treat it as an open wound. It is astonishing how rapidly the phlegmonous process ceases when compared with other methods of treatment. After the symptoms of active inflammation have subsided, the joint is put in proper position and ankylosis is allowed to take place."

Since these remarks by Dr. Gerster, this method of operation has been applied in a large number of cases at St. Sinai Hospital, New York City, with the most satis[illegible]

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whole length of the patella on one side, but did not cut across the tendon, as Dr. Mayo did, but opened it freely and kept it open. He got well with very good motion.

Dr. D. S. Fairchild, Clinton, Iowa—About the time this article was published a case came under my observation, and aided by it I adopted the treatment laid down by Dr. Mayo with excellent results. A considerable degree of motion of the joint was obtained, so that in a few months scarcely any limping was observed in walking, but in running the larger motion revealed the fact that the joint movement was not perfect.

Dr. W. L. Estes, South Bethlehem, Pennsylvania—Before seeing the paper of Dr. Mayo I practiced a similar operation by cutting through the tendon. It is surprising what space it gives us and the facility with which we can clear out the necrosed tissue, and how one gets at the crevices which could never be reached by lateral incision. The suggestion of cutting through the patella, rather than the operation I have employed, is one that I shall adopt in my next case.

Dr. John E. Owens, Chicago—I desire to express my appreciation of this excellent paper. The usual treatment, as has been mentioned by the doctor, we are all familiar with, and it consists of drainage by tubing, etc. If I understood him correctly, he does not ignore that treatment even now. The method which he has so lucidly explained will snatch from the jaws of death a certain percentage of patients and it will save many legs. For these reasons it is an exceedingly valuable contribution.

SOME ADDITIONAL OBSERVATIONS ON THE EFFECTS OF INJURY TO PERIPHERAL NERVES.

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Two years ago I read a paper before the Academy, on "Injuries to Peripheral Nerves," in which a case was related illustrating the effects of a comparatively slight injury to the nerves of the thumb, resulting in very distressing symptoms covering a period of more than two years. The extremely painful symptoms were due to a pressure lesion including the branches of the median nerve supplying the thumb. The amount and density of the connective tissue attending the healing of the wound was remarkable. The healing of the original injury was scarcely accomplished before painful twitching of the thumb occurred. It was at once recognized that the nerve branches were caught in the scar, and it was apparent that relief could be obtained only through surgical means. Twice the scar was dissected out and the nerve freed. Later the external cutaneous and the collateral branches of the median supplying the thumb were resected with the effect of producing paralysis of sensation on the palmar surface, but the pain recurred after the healing, with the addition of painful spasms of the fingers supplied by the median nerve, painful sensations extending up the arm, and

vasomotor paralysis together with somewhat widespread reflex disturbances.

A fourth operation consisted in a division of all the soft parts, including the adductor muscles, nerves and vessels, to the inner side of the original injury down to the bone, at the same time removing the scar tissue, allowing the parts to retract, uniting only the skin with a few stitches and using gauze drain.

The fifth operation consisted in amputating the thumb through the middle of the metacarpal bone. Complete relief would follow each operation for a period of about six weeks, when the old pain would return—although it may be said that after the last operation the pain did not reach its original intensity. in fact, for a few days in succession comparative relief would be obtained. then for several days the pain would be very severe. extending up the arm, and attended with vasomotor paralysis in the hand and fingers, violent and painful flexion of the fingers into the palm of the hand. It was at this time that the case was reported.

At the end of six months, the condition not improving —and, as the pain had increased and the man totally incapacitated for any kind of employment—propositions for further operative procedure were made. The patient was now quite willing to have the median nerve resected with all the crippling effects resulting therefrom, or even to have his arm amputated if it would afford any relief. At the suggestion of Dr. Owens. the remaining portion of the metacarpal bone of the thumb was removed by amputation at the carpo-metacarpal articulation, all the scar tissue dissected out and the median nerve carefully raised and freed from any nerve connective with the thumb—if any existed. The wound healed promptly, but in three weeks the pain returned in all its former intensity. I had already been impressed with the fact that a chronic neuritis existed in the median nerve, and that under the influence of this

morbid condition trophic changes occurred in the new-forming tissue of the wound, resulting in the production of a large amount of dense connective tissue, which exercised a pressure influence on the already irritated nerve. The great suffering of the patient, his utter inability to perform any labor, and my failure thus far to furnish any permanent relief led me to consider every possible means short of the mutilation operation of the median nerve resection or amputation. After considerable reflection, it occurred to me that if I could protect the nerve from the compressing influence of dense scar tissue, something could be accomplished. I therefore secured from a dentist a sheet of gold of the uniform thickness of 1/500 of an inch, 1¾ inches in length and ¾ of an inch in width. This I placed in the sterilizer, and I prepared the hand with great care, observing the most rigid asepsis. I again opened up the wound, dissected out all the scar tissue, lifted up the median nerve as it passed through the wound, on a strabismus hook, to make sure that the nerve was free from scar tissue. When this was done I covered the nerve with the sterilized gold sheet above referred to, pressing it down on each side of the nerve, fitting it evenly so that the nerve could come in contact with the tissues of the hand only at its posterior surface as it passed along its course. The flaps, composed of the skin and subcutaneous tissue—which I had formed in exposing the field of operation—were united over the gold foil with silkworm gut and horsehair. The greatest care was taken at every step of the operation to secure the most perfect asepsis and coaptation of all the parts. The wound was covered with copious dressings which were removed at the end of ten days, when the wound was found perfectly dry and the stitches removed.

This last operation was made April 18, 1899, and about two months later the patient resumed work as

a bridge carpenter, and has continued in this employment since, having been practically free from pain.

When he first resumed work, if he exercised the muscles of his arm much or exposed it to any continued jarring influence, or if he became exhausted from any cause, he would suffer more or less severe attacks of pain, which would however subside after a day of rest. The condition of the nerve gradually improved until at the end of a year he was practically free from pain, whatever he might do. At that time an incident occurred which illustrated the serious nutritive disturbance resulting from two and one-half years of constant irritation. He was employed to pick up nails for three hours, and that night suffered considerable pain, contraction of fingers into the palm of the hand and vasomotor paralysis. This all cleared up without treatment, after a day or two of rest. It may be observed in this connection that the hand was very susceptible to the influence of cold.

At the present time—one and one-half years after the operation—the median nerve may be said to have been restored to its normal state of nutritive stability, and that the man is able to perform any labor adapted to his years and strength with entire freedom from pain.

DISCUSSION.

Dr. J. T. Eskridge, Denver, Colorado—There is one operation devised by Dr. Charles L. Dana, of New York, for the relief of intractable pain resulting from neuritis; this is, to open the spinal canal and cut the posterior nerve roots, between the ganglion and the spinal cord, of those nerves that are distributed to the painful area. The relief of pain is immediate, and will not recur until the severed nerves unite, which probably may be prevented by taking out a sufficient portion of the nerve to prevent this. Most of the cases which have been operated on in this manner have been permanently cured, so far as I have been able to learn.

Dr. D. S. Fairchild (closing)—There is one thing that impressed me very forcibly in regard to the management of these cases, and that was the unusual amount of scar tissue which is developed in nerve injuries, not in these cases partic-

ularly, but in all cases where the nerves are injured. I have treated a good many cases at one time and another of wounds in which the nerves were injured in the wound or at some point above it, and have had that feature to contend with. I have never observed it so strikingly as in this case, and no case has given me so much trouble.

HOSPITAL CARS FOR RAILWAY SERVICE.

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The end of the nineteenth century exhibits marked improvement in the means of alleviating suffering and for saving life. The sick and wounded in the last two wars have had furnished them life-saving appliances and means of transportation never dreamed of in former times. Public sentiment is so exercised in the matter of efficient attention to the needs of the sick and wounded in warfare that it is astonishing that people think or do so little in ordinary civil life in the matter of efficient first aid and comfortable transportation for the much larger number of persons who suffer injury on our railroads. The Interstate Commerce Commission shows that, in round numbers, there were 51,743 railroad casualties to persons in the year just ended. There were 7123 fatalities and 44,620 injuries. The total casualties to the British army in the war in South Africa, up to date, amount to about 48,000.

An interesting compilation of the number of persons killed and injured on the railroads of the United States during the year ending June 30, 1899, has been made by the Interstate Commerce Commission and furnished to the insurance press. During the twelve months 7123 persons were killed and 44,620 injured, a total of 51,743 casualties. In summarizing the accidents, it is found

that 1 out of every 420 employees of railroads was killed, and 1 out of every 27 was injured. Of trainmen, engine drivers, firemen, conductors. etc., 1 out of every 155 was killed and 1 out of every 11 injured. One passenger for every 2,189,020 carried was killed and 1 injured out of every 151,998 carried. During the year 239 passengers were killed and 3442 were injured.

When one reflects that railroad casualties are continually going on, and will continue to occur, while those of warfare are intermittent and frequently far apart, as happily wars are not frequent in modern times, it is astonishing to know that scarcely any efficient system for assisting and caring for injured persons exists on many of the railroads in America. The purpose of this paper is briefly to consider the suggestion of furnishing properly-equipped hospital-cars on railroads for the purpose of caring for the injured and sick persons along their lines, and especially to incite discussion of this important subject from thoughtful, earnest, practical surgeons who are connected with railroads.

The experiment has been tried on a few lines. I know of the Long Island Railroad, the Lehigh and Susquehannah branch of the New Jersey Central Railroad, and I am told that the Plant System also has such cars. The Missouri, Kansas and Texas Railroad has in preparation a car to be used for transporting sick and injured from an emergency hospital to their general hospital. There are probably others of which I know nothing.

I have been able to obtain very little data as to the efficiency and value of the few hospital-cars in use, so I shall have to discuss the subject purely theoretically in the light of the well-known necessities for surgical aid on railways.

1. *Expense.*—A very important matter when it comes to the adoption of the system on a railroad line will be the expense. For the car itself it may be estimated that

$2500 or $3000 will be spent, the expense of its equipment will depend on how complete its appointments shall be made. If the system shall displace other methods of rendering first aid and be more efficient, there must be, besides beds and stretchers, a stock of aseptic dressings and antiseptic appliances, with simple splints, bandages, etc., which would doubtless amount to $300 to $500. At a low estimate, therefore, $3000 would be required to build and equip each car. Besides, the cost of running and transporting the cars over the line would be considerable in the course of a year.

2. *Range of Efficiency.*—Recently I asked an experienced dispatcher about this matter, and in answer to the question, "Under the ordinary conditions which prevail on a busy railroad line, how fast time could you guarantee a hospital-car in moving from one point to another?" He replied, "Twenty-five miles an hour would be about the limit." In other words, it would require about an hour to reach an injured man if he were twenty-five miles away from where the car was located. The reason for this is that the car would have to be sent "special," usually with a slow locomotive, and with chances of failing to get "right of way," or be attached to one of the lesser trains, which are usually slow. The fast express trains are too heavy usually, and their running time too close to add to their burdens; to attach a car to the limited or to side-track the limited for the car running "special" would not be thought of under ordinary conditions. As a means of rendering first aid, therefore, a hospital-car would be too slow to be efficient in a great many, perhaps the majority of instances.

3. *Location of the Car and the Number Required on a Line.*—As noted above, twenty-five miles an hour would, under ordinary conditions, be the expectation of hospital-car service. This might be in two directions, and so make the range of one car fifty miles. In order, therefore, to assure this service of one hour from the

time of its call, there must be one car for every fifty miles of track. When there are a number of lines branching out from a common center, the proper location of the car would naturally be at the center or the point of convergence of the lines. One car under such conditions might serve for a much larger territory. Under the ordinary conditions of trunk lines, however, one car for every fifty miles would be necessary to give service with any degree of promptitude. For a main line of 500 to 800 miles ten to sixteen care would be necessary. Then there would be yards and branches to be cared for, and these would require, for a 500 or 800 miles' system, the addition of five or six cars—a total of fifteen to twenty-two hospital-cars. Yards, reshipping points, crossings, junctions and termini are generally regarded as especially liable to accidents. Wreck cars are, as a rule, not evenly distributed over a line. It would doubtless be well to follow this rule with hospital-cars. Perhaps with every wreck train a hospital-car might be located. I find that about ten wreck cars are allowed to a road of 500 miles of main line track. To follow this last suggestion would provide about the same number of hospital-cars as the first idea of distribution required. Putting them with the wreck cars would assure prompter service in case of serious catastrophes, perhaps; it would delay them, however, in many other instances. They would have to be uncoupled and detached from the wreck train when the hospital-car alone was required.

4. *What Provision Shall be Made for Surgical Service on Hospital-Cars?*—If the cars are to be properly efficient, a surgeon or surgeons must accompany them on all expeditions of mercy. To assure this, it would be necessary to recast the ordinary arrangement of local surgeons along a railroad. It might be made a rule that the surgeon in whose territory the accident occurred should serve on the car. In the East, however, it is

rare for one local surgeon to have charge of a territory of twenty-five miles of road. He might render first-aid and then turn the patient, or patients, over to the next local surgeon on reaching his territory, so that in a transportation of twenty-five miles two surgeons might have to officiate. It is rare on most roads to find, in every section of twenty-five miles, a hospital or place of permanent treatment to which the injured person could be carried. The journey of the car would have to be much longer in some instances. The first surgeon to render aid would have to go far afield, and perhaps leave his location for many hours, or else there would be a large number of changes of surgeons en route. This would, in the last instance, work no end of confusion. Suppose, however, the rule were made that the first local surgeon to render aid must accompany the patient to his destination. The time this would require would be a very serious matter to a surgeon, without any direct pecuniary return for his work and time. Grant, however, that the railroad company would pay for the surgeon's time and work. If it were at the usual rate of fees, very few railroads would stand it. If it were at contract rates, very few efficient medical men would stand it. This service would, to be efficient, require salaried surgeons, and the expense would be very heavy if the men employed were properly qualified. I believe no railroad would stand such expense.

Another arrangement might be made, and in some instances it would not prove inhumane not hurtful, viz.: a local surgeon might render first-aid, see the patient aboard the hospital-car, and put him in such position and condition as would seem proper at the time, and then entrust him on his further journey to a lay employee—a brakeman, flagman or conductor. Surely some one ought to remain in the car with the patient. If it be a lay employee, he must give up his other occupation during this time; this frequently required might

also make a serious expense, and be in a great many instances inexpedient and dangerous.

Another point is: if the car has to leave its own territory, as it must do in order to prevent the evil of transshipment, and very serious discomfort to the injured person in many cases, what provision shall be made for caring for possible accidents during its absence? This might be a very serious matter. It would not do for the next car on the line to take its place, as this would only transfer the evil. It is therefore obvious that a hospital car must be supplemented by other provisions for caring for injured persons.

If the foregoing points are well taken, it is evident that in order to equip a railroad line which has a main line of as many as 500 miles with hospital cars in sufficient number to begin to do efficient service in the majority of emergencies, it would cost from $30,000 to $50,000, and the maintenance and running of these cars would also add materially to the annual expense account. The personnel and the usual arrangement with local surgeons would have to be materially changed. Lastly, and *especially,* prompt and rapid first-aid by means of hospital-cars, under the ordinary conditions, could not be rendered in a large number of individual emergencies. No doubt the sentimental value of a system of hospital-cars for emergency work would be very considerable, but as practical men can we advocate any such system when we know there are other and prompter means of succoring injured people, and which are on this account and perhaps in other respects more efficient?

The argument that a hospital-car furnishes seclusion, comparative comfort and facilities for proper dressings, and even operating-room facilities is frequently used. I am willing to grant the first point, namely, that the car furnishes seclusion and comparative comfort, without argument, *provided the car is at once* available. I have shown, however, that in many instances this will

be utterly impracticable. The value of the other points of the argument are very doubtful. We all know it is much more important that the man who does the first dressing shall have the proper training and experience and know the best modern way of handling injuries than that all proper facilities for doing the dressings shall be provided to a less competent man. As I have said, in writing on the "Treatment of Compound and Complicated Fractures," the fate of the injured person depends very greatly on the man who does the first dressing. I doubt whether it is best for a seriously injured person to put him in the hands of an inexperienced and poorly trained asepticians with all the facilities for doing first-rate permanent work. I mean by this that the inexperienced man will thus be encouraged to attempt dressings which are intended to be the final restitution and rehabilitation of compound fractures, of very severe lacerations, or evulsions. Very rarely, except in minor cases, ought operations be attempted in hospital-cars.

It seems to me that the provisions and effort should be, in handling injured persons on the railroad, to furnish such simple aseptic dressings and apparatus as will prevent any further soiling or infection of the wounds, prevent or control hemorrhage, immobilize injured parts, and to transport the injured person where he may have careful and skilled permanent treatment just as soon as it can possibly be furnished him. Hospital-cars can not do all this. In this age of multiplicity of stationary hospitals along railroad lines, the publicity and some added discomfort in using the old manner of transporting injured persons are far less harmful than delays in delivering them at hospitals where they may find rest and permanent treatment at the hands of experienced men.

Is there then no field, no call, for hospital-cars on railroads? I think there is: 1. On a railroad composed of a

number of short lines radiating from a common center, when the "center" has hospital facilities and the short lines have none, the car may be efficient for conveying relief in apparatus, a skilled surgeon and means of transportation. 2. Suburban short lines could also use a hospital-car efficiently. In both these instances one or two cars would suffice, and these roads could afford to employ a skilled surgeon to accompany the car. In both instances the object would be first-aid and the bringing of the patient to the hospital base, namely, the city in which the terminus might be. 3. Hospital-cars would be very efficient on railroads which have a system of small emergency hospitals along the lines, and one or two "base hospitals" at the termini. They would be used in transporting patients from the emergency hospital to the base or principal one. Dr. Yaney, chief surgeon of the Missouri, Kansas and Texas Railroad, informs me that his road has a hospital-car in preparation for this very purpose. 4. It may be considered utopian and very far ahead of the times, but an especial need for hospital-cars is for—intermittent—use on through express trains, to transport sick and injured passengers.

No doubt all of us can recall many instances of having seen and heard of cases of illness clearly contagious or infectious on crowded trains, in such conditions and stations that they must communicate the specific diseases. It is a matter of the commonest experience for persons suffering from pulmonary tuberculosis to travel long distances on railway coaches. Sleeping-cars are especially apt to be selected for these ailing persons. Efficient disinfection of coaches, especially sleeping-cars, is rarely practiced. It is astounding when one reflects on the subject that sanitarians have been so negatory and slow to appreciate the great danger to the traveling public from the contaminations and infections of railway cars, and that no laws nor rules have been

passed to meet this crying need of modern times. The various states have passed stringent laws requiring the careful embalming, disinfection and hermetic enclosure of all corpses of persons dying of contagious diseases, during their transportation on railroads. Individuals while still alive may travel without let or hindrance, suffering from any one of the contagious or infectious diseases on any railroad in the United States, and as a rule are placed in the very cars which are most sure to be frequented and most difficult to disinfect.

Understanding as we do the usual methods of transmission and the specific cause of pulmonary tuberculosis, it is amazing that no restriction has yet been placed on the transportation of persons who are in advanced stages of this disease. It would be a barbarous prohibition to prevent tubercular persons from using railroad cars in order to go whither their one chance of recovery might demand they should be. It seems to me the only proper, safe, comfortable and sanitary solution of this problem of contagious and infectious disease-spreading custom is for railroads to furnish properly-equipped hospital-cars which may be used to transport any doubtful case of disease to its destination, and so separate it entirely from the other travelers on the train. In order to make this system efficient, the co-operation of physicians generally must be obtained, and the various states should pass laws requiring the use of isolating or hospital-cars for sick persons. When such cars are known to be in use on a railroad line, a physician whose patient was about to make a journey for any reason would simply notify the proper railroad authority, and he would have the hospital-car prepared and attached to a given train. The patient and his attendants would have seclusion, more comfort, and efficient treatment might continue, without any danger to other people on the train.

These cars should be so constructed as to be incon-

spicuous on the outside, and have the simplest fittings inside commensurate with comfort and efficiency, and everything inside should be so arranged and constructed that thorough disinfection after, and proper sanitation during, the use of the car might be obtained. Two or three cars of this kind would be all that were necessary on a line of a thousand miles of main track. If they were properly stationed, they might also prove very efficient in cases of serious catastrophes along the line.

I wish it clearly understood that in recommending hospital-cars for express trains I do not advocate the abrogation of the usual ordinary laws of isolation which nearly every community has in vogue for the purpose of preventing the spread of contagious and infectious diseases, nor do I recommend common and frequent transportation of these cases, but as they so often travel surreptitiously, it would be far better to have proper provision for this transportation, and, under stress of circumstances or necessity, they might safely thus be carried. When, furthermore, it was known that proper provision was made for their comfort and care, the sanitary authorities might permit removals which would be of great benefit not only to the sufferer but to communities. The value of these cars for transporting tubercular persons, those having typhoid fever, and those having some forms of specific enteritis can not be questioned, both for the infected person and for the traveling public as well.

DISCUSSION.

DR. J. B. LACEY, Council Bluffs, Iowa—There is one idea which occurs to me in regard to the transportation of patients with infectious diseases, particularly tuberculosis, and that is, can the railroad company dictate where a person shall ride, or who shall be the individual to say where he or she, as the case may be, shall ride? We know that the Pullman Palace Car Company furnishes a certain quality of cars. The upholstering in these cars is put there for the specific purpose of comfort. We know that tuberculous patients, or those with infectious diseases, should not be placed in cars where there

are plush coverings and fine upholstery. A patient may be accompanied by some member of the family, a daughter, a son, a father, or mother, and the doctor will say that they shall be furnished with a hospital car, but as soon as they see this car they find that it is not luxurious, not comfortable, and it is not what they are taught to understand as being up to date for the purpose of comfort, and they insist upon going into a Pullman car. Who is to say where they shall ride?

DR. J. P. LORD, Omaha, Nebraska—I was very much entertained in listening to the paper of Dr. Estes, and I regard it as a valuable one. In these days, when we have all sorts of luxuries added to our railway trains, such as the barber shop, the bath, and a number of other luxuries for the convenience of those who want to avail themselves of these facilities, the thought occurred to me, during the reading of the doctor's paper, that perhaps instead of recommending so extensive accommodations as a whole car, that if one end of a car were set aside, the space being no greater than that occupied for the smoking-room and toilet-rooms of ordinary sleepers, with a small operating room with all conveniences, many of these facilities could be placed in compact form in such a car, and with one or two separable compartments for beds, it would not be a considerable outlay of money to the company, and it would perhaps furnish as great a demand as would ordinarily be put upon the company either for the treatment of its employes or the care of individuals the subjects of accidents or disease. This would be a starter and within reach of the company, and I believe would be much appreciated by all concerned, that is, the traveling public and the employes of a road. The end of an express car would be a good location for such an arrangement.

DR. ESTES (closing the discussion)—I covered the point made by the first speaker (Dr. Lacey) with reference to the furnishings of the car. Some people might object to them. I think the laws in each state should require that people sick with certain specific diseases shall of necessity travel on cars provided for them, and that it shall be required of railway companies that they furnish these cars, and that while the cars should never be so luxurious in their appointments that they can not be thoroughly, efficiently, and systematically disinfected, yet they may be made decidedly comfortable without having a number of hangings or plush coverings. Those who have been sick and feverish on Pullman cars know that there is nothing more uncomfortable than plush when they are in such a condition.

I have thought about utilizing part of a car as a beginning, but there are two practical points which militate decidedly

against that, and one is that to utilize the end of a car, if it means only a quarter section of it or less, it would be very much cramped. It would be difficult to put in such things as would be comfortable, and it would be almost impossible to enter that section of the car without communicating with the other section, which is a point that will be fought against. Another thing is, that if it is going to be an express car, the ordinary location of the express car is in front of the train, whereas a hospital car is, or should be, in the rear. A hospital car ought always to be in the rear, if properly isolated, and that would be the great advantage of having a hospital car. The managers of railroads ought to be educated to provide luxuries for the sick and to prevent people from getting sick, and why should we not insist, as practical railroad sanitarians, that the railroad companies provide for the people who, in their distress and suffering, need especially the comforts and isolation provided for or suggested in the establishment of one of these hospital cars?

SOME REMARKS ON THE PLANTAR REFLEX, WITH ESPECIAL REFERENCE TO THE BABINSKI PHENOMENON.

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Believing that the duty of the specialist in this association, working in a special line other than surgical, is to bring forward for discussion, observations and recent discoveries on mooted points that will aid the railroad surgeon and physician in the diagnosis of certain diseased conditions, I shall attempt to give the generally accepted views, of neurologists at least, on the value of the "Babinski sign," the pathological plantar reflex; or, better yet, slow extension of the great toe, with or without extension and separation of the other toes, as an aid in diagnosing disease in certain portions of the central nervous system.

My observations have been made on 830 cases, 380 in hospital and 450 in private and consulting work. Besides, 2550 cases taken from my old records, I have utilized for the purpose of determining the frequency of the plantar reflex in nervous diseases in general. I wish to express my indebtedness to Drs. Delahanty, Hall, Sewall and Freeman for the privilege of investigating the plantar reflex in their cases in the Arapahoe County Hospital, and to the resident physicians of that institution for the intelligent assistance freely rendered

me by them; also to Dr. Hopkins for permitting me to observe cases under his care in St. Anthony Hospital; likewise to Dr. Lemen for allowing me to utilize the U. P. patients in St. Joseph's Hospital. I wish to thank the nurses in training in St. Luke's and Arapahoe County hospitals and some of the graduate nurses of these institutions for permitting me to investigate their plantar reflexes.

The Babinski sign is a comparatively new one, even in neurological diagnosis, and I do not fear of being accused of bringing a subject worn threadbare before an association composed mainly of railroad surgeons and physicians.

I wish to state, before going further, that I do not intend to discuss theories in this paper. My object will be to present facts and draw conclusions that I hope may aid in the diagnosis of disease in certain portions of the central nervous system.

The Normal Plantar Reflex in the Adult and the Method of Eliciting It.—If I were to include the whole phenomena of the plantar reflex I should have to note the contraction of several of the thigh muscles and some of the leg muscles which usually contract before the toes are flexed. My remarks are for railroad surgeons and physicians, and not for the neurologist. I shall, therefore, limit, for the most part, what I have to say to the movements of the toes. With this limitation, the normal plantar reflex consists in flexion of one or of all the smaller toes and frequently of the great toe on moderate stimulation of the plantar surface of the foot. The flexion sometimes delayed for a brief moment after stroking the foot is rapid, usually most marked in the outer toes, may be limited to these, but is often accompanied by flexion of the great toe. As a rule, a little firmer stroking of the plantar surface of the foot is necessary to cause flexion of the great toe than of the smaller toes. It must be remembered that flexion

of the toes is usually accompanied or immediately followed by inversion and dorsal flexion of the foot at the ankle. Care must be taken not to mistake this for extension of the toes. Strange as it may seem, I have seen this error made on more than one occasion.

Precautions Necessary in Eliciting the Plantar Reflex.—In the first place the leg must be in a comfortable position, and so placed as to prevent any of the muscles of the leg or foot being put on the stretch. If the patient is nervous, and apprehensive of being hurt, it is wise to distract his attention from your investigations by engaging him in conversation. The same object may be accomplished by covering his eyes and beginning the examination by testing his tactile sensation with a camel-hair pencil. After his attention becomes concentrated on this method of procedure, the plantar surface of the foot may be gently stroked, and in the majority of instances the patient, not suspecting the object of the physician, will answer: "I feel that." The stroking should be the lightest that will elicit the reflex, but at the same time if the gentle stroking fails to cause any plantar reflex, the irritation should be increased in vigor until one is satisfied that there is no plantar reflex present. The plantar surface may be irritated on the outer or middle portions, stroking from the heel toward the ball of the foot, or from the outer to the inner surface just posteriorly to the ball of the foot. Stroking the inner side of the plantar surface often causes the most contraction of the toes, but it has the disadvantage of giving rise to greater movement of the foot, inversion and dorsal flexion at the ankle. The finger-nail, or what I have found better, the quill holder of a camel-hair pencil, answers every purpose for an object with which to stroke the foot. If the patient's attention is not directed to what one is doing when he is testing the plantar reflex, voluntary and semi-voluntary movements of the foot and leg are

least likely to complicate the results. The plantar surface of the foot should be dry and warm when the reflex is tested.

The normal plantar reflex may be modified by age, sleep and stupor or coma, especially in children, mental development, the condition of the plantar surface, dropsy of the feet and legs, trophic changes in the feet from old nervous lesions and by ankylosis of the toes.

Age.—In the healthy adult the plantar reflex, if present, may be lessened during sleep and other unconscious states, but it is probably always attended by flexion of the toes. In infants, before they begin to walk, the plantar reflex, while brisk as in the adult, is somewhat irregular, and may be attended by contraction, or by extension and separation of the toes. Collier[1] states that in infants the extension of the toes continues in healthy subjects up to the end of the first or second year; in the weakly until the fourth year, and is occasionally found up to the sixth or twelfth year when the child is asleep. In the latter group of cases the adult reflex returns as soon as the child is awakened. Personal experience in examining the plantar reflex in infants has proved very unsatisfactory to me. The feet of infants when exposed are always in constant motion, especially while under examination. The movements consist in extension and separation of the toes, followed by rapid flexion. It has often been very difficult for me to determine whether the toe movements were more extension than flexion. I have not been able to examine the plantar reflex of infants while they were asleep in a sufficient number of cases to enable me to draw any conclusions. In one I found the reflex absent so far as the toes were concerned, in two there was flexion of the toes followed by extension, and in three the toes quickly extended and separated, followed a few seconds later by flexion.

Cohn, Schüler, Watson, Paul, Sachs and others have apparently met with equally unsatisfactory results in examining children in health.

Delayed or arrested development is often attended by an irregular plantar reflex. I have recently seen a case of idiocy in a boy of 6 years in whom the infantile type was preserved, and another in a girl of 20 years in whom the infantile type was present when the patient was asleep, but the irregular adult type appeared on arousing the girl.

The plantar reflex may be lessened or abolished by anything that lessens the sensibility in the plantar surface, such as lesions in the nerves, cold and dampness, dropsy and trophic changes of the feet and also by ankylosis of the toes.

Variations of the Plantar Reflex in Apparently Healthy Adults.—Is the plantar reflex ever continuously absent in healthy adults, and may it be absent in one foot and present in the other under such circumstances, even when all the necessary precautions are taken in testing for the reflex?

Collier says: "If the preceding points are taken into consideration, I think that the common statement that the plantar reflex is not rarely found completely absent in healthy subjects will not be confirmed."[1] Fraenkel and Collins say: "We have never found it absent without adequate attributable cause, such as peripheral neuritis."[2] Knapp and Langdon hold the same view.[2]

On the other hand, Blocq and Onahoff think it is frequently absent.[3] Schüler, Cohn, Walton and Paul found the reflex absent in 10 per cent. of healthy subjects.[4]

I have records of 100 healthy subjects in whom I carefully investigated the plantar reflex and found it absent on both sides in 9 per cent., after excluding a series of 7 subjects whose cases will be referred to presently. In the 100 subjects I endeavored to take

every necessary precaution. If the feet were cool or moist I had them rubbed with a coarse towel until the plantar surfaces were dry and red. Then after waiting a few minutes I covered their eyes and carefully tested the plantar reflex. Fearing that the vigorous rubbing with a coarse towel might have abolished the plantar reflex for the time being, I re-tested the cases some hours later, and still the results remained the same.

The most remarkable results were obtained on testing the plantar reflex in 7 healthy, strong and vigorous nurses while on duty in the wards of the Arapahoe County Hospital. The feet of all were warm and dry. In 1 only was the plantar reflex present in both feet; in 1 it was absent in one foot and present in the other —flexion—in 5 the reflex was absent on both sides. These tests were made at about 5 p.m., after the nurses had been on their feet all day. Thinking, possibly standing on the feet for so many hours might have something to do with abolishing the plantar reflex, I visited the hospital the following morning at 7:25 a.m., before the nurses had gone on duty, and re-investigated the reflex, but to my surprise there was no change to record in the results that I had obtained the previous afternoon, except that in the one with normal reflex in one foot, the reflex was found absent in both feet. These results would lead one to suspect that occupation has something to do with modifying the plantar reflex in health and possibly in disease.

I should remind you that these observations had to do with the toe movements alone. The curious results that I obtained on examining the plantar reflex in 7 nurses determined me to examine the plantar reflex in as many nurses as I should be able to obtain for investigating the reflex under consideration. I shall have, therefore, some 47 other nurses in whom I have to report the condition of the plantar reflex before I close this paper.

It is well known that the plantar reflex may soon be exhausted in many healthy subjects, that it may be present at one time and absent in another, but that it may be absent without any appreciable cause is important to bear in mind.

In answer to the second inquiry: "May the plantar reflex be absent in one foot and present in the other in healthy subjects, even when all necessary precautions are used in testing the reflex?" Dr. Knapp is of the opinion that such a condition is not found unless there is some disease of the nervous system. Drs. G. L. Walton and W. E. Paul, in their excellent article in the June number of the *Journal of Mental and Nervous Disease,* of the present year, give the results of their examinations of the plantar reflex in 100 normal subjects as follows: "All, or some, toes—generally the outer—of both feet flexed in 75 per cent.; no movement, 10 per cent.; flexion on one side, no movement on the other, 15 per cent." In the 100 apparently normal subjects of which I have notes plantar reflex was present on one side and absent on the other in 5 cases.

It seems to me that if one will investigate the plantar reflex in a number of healthy subjects he will have to admit that this reflex may be absent in one or both feet in a small percentage, probably from 8 to 12 per cent.

The Babinski Phenomenon or Pathological Plantar Reflex.—This consists in rather slow and deliberate extension of the great toe with or without extension and separation of some or all of the other toes on stroking the plantar surface, as is done in attempting to test the normal plantar reflex. The pathological reflex differs from the normal reflex in three ways. 1. The great toe makes the greatest and sometimes the only movement. 2. The movement is one of extension and separation, the latter most marked in the

[illegible] toes. 3. The movement, especially well marked [illegible] great toe, is much slower than in normal flexion [illegible] gives rise to the impression of deliberation. I [illegible] illustrate the difference by testing the normal [illegible] pathological reflex in the subjects whom our [illegible], Dr. Wheaton, has kindly arranged to have [illegible] at this session of the Academy.

[illegible] 1896, Babinski first called our attention to the [illegible] movement of the great toe with or without [illegible] or separation of the other toes in connection [illegible] of the pyramidal tract. His first paper [illegible] not to have attracted much attention, as it [illegible] apparently overlooked in the proceedings of a [illegible] society.[5] He continued to investigate the [illegible] and two years later described certain characteristics of the pathological movement, namely, that [illegible] slower than flexion, and that while flexion [illegible] in healthy subjects when the inner side of [illegible] surface is stroked, the reverse of what holds [illegible] extension of the toes. The second communication [illegible] a great deal of attention, especially on [illegible] of Europe and to a much less extent [illegible] I have been unable to find any records [illegible] investigating the pathological reflex [illegible] prior to the publication of Dr. James [illegible] on the plantar reflex—both physiological [illegible]. This paper appears in *Brain*, vol. [illegible] 71, for 1899.

[illegible] *Journal of Mental and Nervous Disease* for [illegible] 397, Drs. G. L. Walton and W. E. Paul [illegible] long list of investigators who have studied [illegible] in health and in various diseases.

[illegible] one by Walton and Paul,[4] devoted to [illegible] of the plantar reflex, and one by [illegible] Collins,[2] giving a short consideration to [illegible] read before the recent meeting of the [illegible] Neurological Association. In the discussion

that followed a number of the prominent members participated. You see that the pathological or Babinski plantar reflex has not been prominent before the medical profession for more than two years, yet it has received general attention from the neurologists, both in Europe and America, as a diagnostic sign.

A résumé of the results obtained by various investigators of the pathological plantar reflex may be summed up in a few paragraphs. I must thank Drs. G. L. Walton and W. E. Paul for making this easy for me, as I shall still further condense their condensed summary.

Babinski in his first report—1896—simply called attention to the fact observed by him that in pyramidal disease, stimulation of the plantar surface of the foot on the affected side was followed by extension of the great toe, and often by extension and separation of the smaller toes. He termed this *le phénomene des orteils*. Two years later—1898—he called attention to further particulars, the most important of which was, that the extensor movement of the toes is slower than flexion, and that flexion is stronger when the inner side of the plantar surface is stroked, the converse being true of extension. He reported mixed varieties which he thought were pathological and physiological, as stroking one part of the foot would cause flexion and another part extension, the first part of the reaction being flexion, followed by extension. Again, he noted in some cases extension of the inner toes and flexion of the outer ones resulting from the same stroke. His observations were confirmed by fourteen observers, including Collier, of England, and Langdon, of America. There seemed to be a unanimity between the fourteen observers, in that the toes, especially the great toe, would be slowly extended on stroking the plantar surface of the affected foot in diseases of the pyramidal tract.

Collier, while he maintained that the toes extended

pyramidal disease in the adult on stroking the plantar surface, that the movement is slow, that the great toe movement preceded the movement of the smaller toes, found a similar movement in infants except that it is quicker. He also found that extension of the toes is the only reflex movement in total transverse lesion of the cord. He was able to obtain the extensor plantar reflex in a case of tetanus and in a case to which he had given large doses of strychnin. Babinski reported a case of strychnin poisoning in which the extensor plantar reflex was present.

"Gordan and Le Sourde found the extensor reflex in 92 per cent. of the 68 hemiplegiacs examined, and in all the 45 cases of spinal disease implicating the pyramidal tract except one case of neuritis also—in all the 6 cases of syringomyelia, and in all the 30 cases of infantile hemiplegia and diplegia."[4]

Dr. J. W. Lamedee says: "The constancy of extension plantar reflex on the paralyzed side in organic cerebral hemiplegias is such as to render the Babinski sign here a very valuable diagnostic aid, especially in the unconscious patient. The sign is present in recent and old hemiplegias, appearing usually within a few hours after the stroke and before the knee-jerks return."

In looking over Lamedee's 110 tabulated cases in which the plantar reflex was tested, I find in one case of right hemiplegia the right plantar reflex was irregular or absent and left absent. In a case of left hemiplegia, the plantar reflex was flexion, left, slight [illegible] absent. In another case of left hemiplegia the [illegible] reflex on both sides was flexion, but the [illegible] and passed away. In one case of [illegible] implicated by meningitis and gumma, [illegible] was flexion, most pronounced in the left. He also reports one case of hysterical contracture, [illegible] of the entire left side—face, arm and [illegible]. The plantar reflex in this case was right, flexion;

left extensor. He states that the affection of the left side could be made to disappear on hypnosis. If this case No. 58 in his table was hysterical in character, the extensor reflex did not mean organic disease in this case at least. Personally, I do not believe that a paralysis and contracture which disappear under hypnosis must necessarily be functional in character.

On the other hand, let me give the views of three other observers who are less inclined to accord to the extensor plantar reflex so great a value in diagnosis. Giudiciandrea states that he found plantar extension in hysteria and in normal individuals. Schüler found extension plantar reflex—notably of the great toe—in 8 per cent. of the men examined, in 10 per cent. reflex was absent, and in two indeterminate; in normal women 4 per cent. extension, in 10 per cent. absent, and in 6 per cent. doubtful. In 8 cases of pyramidal-tract disease extension was present and pronounced. In children the reflex was either absent or rather unsatisfactory. Cohn found flexion in 60 per cent. of healthy persons; extension of the great toe, with either extension or flexion of the others, in 20 per cent.; absent reflex in 10 per cent.; and variable movements in 10 per cent. He found the plantar reflex generally absent in infants, but when present it was usually extension; usually extension in recent cases of apoplexy; in 4 cases of spinal spastic disease, extensor reflex in 2. In one case of hysterical hemiplegia he found extension on the paralyzed side.[4]

Schwab gives Cohn's conclusions as follows: "In the majority of all persons an irritation of the sole of the foot is followed by flexion of the toes. In lesions of the lateral tract of the spinal cord of an organic character, an extension reflex is to be observed. In no way, however, can this phenomenon be regarded as a certain pathognomonic symptom for the recognition of such disease."[5]

In the two recent papers which treat of the plantar reflex in disease of the pyramidal tract, Collins and Fraenkel state: "From our observations, we have corroborated the findings of Babinski, Van Gehuchten, Collier and others, that this type of plantar reflex—the extensor—is not found in normal individuals, and that when carefully examined with the precautions mentioned above, it is found only in cases in which there is unmistakable evidence of disease of the pyramidal tract."

In paragraphs numbered 3 and 4 of Walton and Paul's conclusions, we read as follows: "3. The Babinski reflex obtains in about 70 per cent. of hemiplegics and diplegics, and in approximately the same percentage of cases with disease involving the pyramidal tract in the spinal cord." "4. The Babinski reflex—deliberate and constant extension of the great toe, with or without extension and separation of other toes—is never present in health, and our observations lead us to doubt its existence in either functional or organic nervous or other disease not implicating the pyramidal tract."[4]

Personal Observations on the Plantar Reflex, both in Health and in Disease.—From 1878, when I first began to pay especial attention to the diseases of the nervous system, till the spring of 1899, the time when I first became familiar with Babinski's investigations, results and conclusions, I paid strict attention to the plantar reflex, but failed to observe the important points to which Babinski has so recently called our attention. During the past eighteen months, or since the spring of 1899, I have investigated the Babinski phenomenon in nearly every case that I have seen at my office, in consultation, or in St. Luke's Hospital. It was not until a few weeks ago that I utilized any of my cases seen and studied prior to my becoming acquainted with the Babinski phenomenon and the methods and precautions necessary in investigating it.

In looking over my records from 1878 till 1898, I find the plantar reflex was registered as follows: Plantar reflex R. present or absent; L. present or absent, with a note as to whether the foot was flexed toward the dorsal or plantar surface.

It will be seen that I can utilize my old material only as to whether the plantar reflex was absent or present.

I have been unable to look up the records of all my old cases of nervous and mental diseases, but have been able to ascertain whether the plantar reflex was absent or present in 2550 recorded cases. In the hospitals I have studied the plantar reflex with especial reference to the Babinski phenomenon in 380 cases. In office and consultation practice and in private work in St. Luke's Hospital I have studied the plantar reflex in 450 patients suffering from organic or functional nervous diseases, or from insanity, a total of 3380, 2550 of which are of little importance in the study of the Babinski phenomenon. I shall first give a short analysis of the 2550 old cases of nervous and mental diseases.

Tumor of the brain, 100 cases: In 40 cases the pyramidal fibers were involved either directly or indirectly, and the plantar reflex was present in all on the affected side until just before death, when on account of exhaustion they disappeared. On the unaffected side of the plantar reflex was present in 38 cases and absent in 2. When the patients became greatly exhausted just before death the reflex disappeared on both sides. In the 60 in which the pyramidal tracts were not affected the plantar reflex was present in 54 cases; in 3 absent and in 3 the reflex was present on one side and absent on the other.

Intradural tumors of the cord, 5 cases: Plantar reflex was present in 3, absent late in the disease in one and present on one side and absent on the other in one.

Abscesses of brain, 12 cases: In all, the pyramidal fibers escaped; 4 of the cases were seen early in the disease and the plantar reflex was present in these; 8 cases were seen when the patients were becoming exhausted; the plantar reflex was present in 6 and absent in 2.

Cerebral meningitis, 75 cases: Sixty of these were tubercular, 50 in children, 10 in adults, 7 syphilitic and 8 from suppuration of the middle ear. In the 50 tubercular cases in children

from a few months to 12 or 13 years of age the plantar reflex was absent in all after coma set in. In the 10 tubercular cases in adults the plantar reflex was absent in 8 and present in 2. Patients greatly exhausted. In the 7 syphilitic the plantar reflex was present in 4, absent in 2 and irregular in one. In the 8 from suppuration of the ear the plantar reflex was present in 4 and absent in 4.

Syphilis of the brain and cord, 100 cases: In 56 plantar reflex was present, in 30 absent and in 14 irregular.

Hemiplegia from vascular lesions, 150 cases: On the paralyzed side plantar reflex was present in 130 cases, absent in 10 and irregular in 10.

Bilateral thrombosis, 2 cases: Plantar reflex was present in both.

Posterior spinal sclerosis, 100 cases: Plantar reflex, although in some cases it was feeble, was present in 35, absent in both feet in 48, absent in one foot and present in the other 17.

Multiple neuritis, 20 cases: Plantar reflex present in 8, absent in 12.

Anterior poliomyelitis, 40 cases: Plantar reflex present in 24 cases, absent in 16 in which changes were well marked.

Neuritis of the sciatic nerve, 10 cases: Plantar reflex was present in all.

Pressure neuritis of the sciatic nerve, 20 cases: Plantar reflex present in 18 cases and absent in 2.

Pressure neuritis of the nerves of one or both legs, 12 cases: Plantar reflex present in 8, absent in 4 cases.

Myelitis, 60 cases: In 10, cervical, plantar reflex was present in all. In 20 dorsal, plantar reflex was present in all. In 30 dorso-lumbar plantar reflex was absent in all.

Complete transverse lesion of the cord, 6 cases: No plantar reflex was present.

Spinal caries, 50 cases: Plantar reflex was found in all above the lumbar region, absent in all cases of the dorsolumbar region with distinct cord symptoms.

Friedreich's disease, 8 cases: Plantar reflex was present in all.

Paralysis agitans, 8 cases: Plantar reflex was sluggish in all.

Hysteria, 50 cases: Plantar reflex was present in 29 cases, absent in 21.

Neurasthenia, 100 cases: Plantar reflex was present in 90 cases and absent in 10.

Nervous irritability—commonly known as simple nervousness, 93 cases: Plantar reflex was present in 85 cases and absent in 8.

Chorea, 50 cases: As far as I could determine, the plantar reflex was present in all, but the wild movements of the feet made in some cases accurate observation impossible.

Epilepsy, 100 cases: Plantar reflex was present in 93 and absent in 7.

Traumatism to the head, 60 cases: Plantar reflex was manifest in 40 and absent in 20.

Traumatism to spine and cord, 40 cases: Plantar reflex was present after the shock was over in all cases in which the injury was above the dorsolumbar region, provided the cord was not completely severed.

Deaf-mutes, 25 cases: Plantar reflex was present in 22, absent in 3.

MENTAL DISEASES.

Dementia, 200 cases: Plantar reflex was present in 80, absent in 104, present in one foot and absent in the other in 16.

Paretic dementia, 200 cases: Plantar reflex was present in 120, absent in 50 and irregular in 30.

Mania, 200 cases: Plantar reflex was present in 190, absent or irregular in 10.

Melancholia, 200 cases: Plantar reflex was present in 60, absent in 120, and irregular or absent in 20.

Paranoia, 250 cases: Plantar reflex was present in 200 cases, absent in 20, irregular in regard to the two sides in 30.

Feigning, 30 cases: Plantar reflex was present in 26 cases, absent in 2, present on one side and absent on the other in 2.

Stuporous melancholia, 20 cases: Plantar reflex was absent in all.

Melancholia attonita, 10 cases: Plantar reflex was present in 6 cases and absent in 4.

Weak-minded children, varying in age from 8 to 15 years: Plantar reflex was present in 40 cases, absent or irregular in 10.

Imbecility, 75 cases: Plantar reflex was present in 60 cases, absent or irregular in 15.

Idiocy, 25 cases: Plantar reflex was present in 19, absent or irregular in 6.

The average percentage of the presence or absence of the plantar reflex in each of the above individual nervous diseases is approximately as follows:

Tumor of the brain, present 85, absent 15; intradural spinal tumors, present 100; the plantar reflex was lost in all before death.

Abscess of the brain, present 83.3, absent 16.7; meningitis in stage of coma, present 13.3, absent, 86.7; syphilis of the brain, present 70, absent 30; hemiplegia from vascular lesions present 90, absent 10; bilateral thrombosis, present 100: posterior spinal sclerosis, present 52, absent 48; lateral sclerosis, present 100; anterior poliomyelitis, early present 90, absent 10: multiple neuritis, present 40, absent 60; in inflammation

of the sciatic nerve, present 100; pressure neuritis affecting the sciatic nerve, present 90, absent 10; pressure on several nerves of one or of both legs, present 66.7, absent 33.3; myelitis, present 50, absent 50; complete destruction of cord, absent 100; caries of spine above dorsal region, present plantar reflex, 100; in dorsolumbar with involvement of cord, absent plantar reflex 100; Friedreich's disease, present 100; hysteria, present 58, absent 42; neurasthenia, present 90, absent 10; nervousness, present 91.5, absent 8.5; chorea, present 100; epilepsy, present 93, absent 7; traumatism to head, present 66.7, absent 33.3; traumatism to spine, present 70, absent 30; deaf-mutes, present 88, absent 12; dementia, present 48, absent 52; paretic dementia, present 60, absent 40; mania, present 95, absent 5; melancholia, present 33.3, absent 66.7; paranoia, present 90, absent 16; feigning, present 93.3, absent 6.7; stuporous melancholia, absent 100; melancholia attonita, present 60, absent 40; weakmindedness, present 80, absent 20; imbecility, present 85.7, absent 14.3; idiocy, present 76, absent 24.

The average percentage in which the plantar reflex was present or absent in the 2550 old recorded cases is as follows: The plantar reflex was present in one or both feet in 77.8 per cent; it was absent in both feet in 22.2 per cent.

I have found from observation that the simple presence or absence of the plantar reflex in organic nervous disease especially, but sometimes in the functional, depends largely on the vigor or physical exhaustion of the patient at the time the test is made. For instance, vigorous physical exercise for fifteen or twenty minutes in the gymnasium apparently does not modify the plantar reflex, but, on the other hand, laborious work carried to the point of almost complete exhaustion will abolish the reflex. In the case of multiple neuritis the plantar reflex is present and vigorous extremely early in the disease. In nearly all severe cases, at the height of the disease, especially if there are great physical exhaustion and trophic changes in the feet, the plantar reflex is almost invariably absent. After diphtheria, if the plantar reflex becomes excessive, I have learned to fear multiple neuritis.

Tumor and abscess of the brain are no exception

to the general rule, that in complete exhaustion preceding death the plantar reflex usually disappears.

Since my attention was called to Babinski's observation on the plantar reflex, which was about eighteen months ago, I have carefully examined the reflex with especial reference to this phenomenon.

I examined 100 patients in the hospital, apparently free from any nervous or other trouble that should affect the plantar reflex, using every necessary precaution, and I obtained the following results: Plantar reflex present, 86; absent, 9; absent on one side and present on the other, 5. There was no Babinski phenomenon in any of these.

The above percentage of absent plantar reflex in the normal subject is in line with the results of Walton and Paul, and with those of several other investigators, but contrary to the views of Knapp, Langdon, Collier, and Collins and Fraenkel. The number of cases in which I found the plantar reflex in one foot and absent in the other is less than the results obtained by Drs. Walton and Paul.

Early in this paper I mentioned the fact that in seven nurses on duty in the Arapahoe County Hospital I found the plantar reflex absent in 5; present in both feet in 1, and absent in one foot and present in the other in 1. These results seemed so remarkable that I decided to examine the plantar reflexes of the nurses in St. Luke's and Arapahoe County Hospitals. I found 54 vigorous and strong nurses, both in the hospitals and among graduates doing private nursing outside, who were willing to have their plantar reflexes examined. The results were as follows:

The plantar reflex was absent in 63 per cent., and present and normal in 11, or about 20.3 per cent. It was irregular, such as present in one foot and absent in the other, spreading of toes, flexion or extension of one or more of the small toes and flexion of the great

toe and extension of small toe in 9, or 16.7 per cent.

There must be some steadily acting cause in nurses to give rise to the absence of plantar reflex in such a large percentage of healthy individuals. My first theory was that it was because the nurses were on their feet so many hours, but on re-examining the nurses in the early morning whom I had examined after a day's work, I found no changes practically in the plantar reflex. I then examined my own plantar reflex and found it present and normal both night and morning. I was forced to abandon this theory. In looking over my records of 2550 old cases and finding that the plantar reflex disappeared in nearly all cases of extreme exhaustion, especially just before death, in tumor and abscess of the brain and in the profound comatose stage preceding death, I felt that the frequent absence of the plantar reflex in nurses was caused by exhaustion from overwork. I again re-examined my own plantar reflex when I felt extremely exhausted from trying to work a few hours after suffering from an attack of cholera morbus. In this instance I found my plantar reflex absent. Another time, after getting exhausted [illegible] reflex was present in one foot, absent in the other.

It would be interesting to examine the plantar reflex [illegible] men after a hard day's work. In looking [illegible] Walton and Paul's[4] paper two paragraphs [illegible] attracted my attention in this connection. [illegible]

[illegible] cases, apparently healthy, taken from the [illegible] and other places outside of a hospital, they [illegible] reflex as follows: In 75 per cent. normal [illegible] no movement in 10 per cent., and in [illegible] flexion on one side and absent reflex on the [illegible]

[illegible] patients taken at random from a general hos[illegible] especially selecting those who were not suffering [illegible] disease that would interfere with the plantar

reflex the averages were as follows: Flexion of toes—generally the outer—87 per cent., absent reflex in 9 per cent., flexion on one side and absent movement on the other, 4 per cent.

The hospital patients, who were doing practically nothing, showed a higher number with normal plantar reflex, 87 per cent., than the 100 who resided without the hospital.

In the case of the nurses that I examined, I noted how long each had been in training. I found the plantar reflex absent nearly as frequently in nurses who had been in the school a few weeks or months as in those who had graduated or been in training nearly all of their required time. But here again I found that most of the nurses had come from positions that had required them to be on their feet a great deal.

If observations show that those who have absent plantar reflex for prolonged periods are more subject to certain diseases than those who have a normal reflex, our duty as physicians will be plain.

Examination of 7 healthy children: Extension of all the toes when the children were asleep in 3; unsatisfactory examination in 4, principally on account of the constant movement of the feet while I was trying to examine them. Sometimes the toes would apparently flex on irritating the plantar surface, but on pursuing the examination they would extend and again flex. The ages of the children varied from five days to three months.

Plantar reflex in 40 surgical cases: Normal reflex was present in 30, 75 per cent.; absent in 10, 25 per cent. In 4 of the cases marked flexion of the toe movements were very irregular. In one there was flexion of all the small toes in one foot and absent reflex in the other; in the second there was abduction of the little toe in one foot and quick extension of the great toe in the other; in the third, separation, without flexion or ex-

tension, of all the small toes, the great toe remaining quiet; in the fourth, nearly the same phenomenon was observed as took place in the third.

Typhoid, 17 cases: Normal reflex was present in 12, 70.5 per cent.; absent reflex in 3, 17.5 per cent.; flexion in one foot and absent in the other, 2, 12 per cent.

Consumption, 13 cases: Plantar reflex was present in 11, 84.7 per cent.; absent in 2, 15.3 per cent.

In 50 medical cases: Plantar reflex was present in 46, 92 per cent.; absent in 4, 8 per cent.

In the 240 cases just reported, in which there was no evidence of disease of the pyramidal tract, the Babinski phenomenon was not found in one. In one case the right great toe extended but the movement was quick and jerky, all the other toes remaining quiet.

NERVOUS DISEASES—100 CASES.

Dorsal and cervical myelitis: 7 cases with extensor plantar reflex, 100 per cent.

Dorsolumbar myelitis: 7 cases, absent reflex in all, 100 per cent.

Complete destruction of cord: One cervical, 2 dorsal and 4 lumbosacral, 7 cases; plantar reflex was absent in all, 100 per cent.

Idiopathic muscular atrophy, 2 cases: Plantar reflex was absent in both, 100 per cent.

Hemiplegia, 10 cases: Plantar flexion was present in 9 cases 90 per cent; absent in 1, 10 per cent.

Epilepsy, 4 cases (using bromid): Plantar reflex was absent in all, 100 per cent.

Locomotor ataxia, 6 cases: Plantar reflex was present in 2, 33.3 per cent.; absent in 4, 66.7 per cent.

Plantar reflex was absent in 1 case swollen feet from heart disease, 100 per cent.

Swollen feet from kidney disease, 5 cases: Plantar reflex in all was absent, 100 per cent.

Bilateral thrombosis, 2 cases: Flexion plantar reflex was present in 100 per cent.

Delirium tremens, 2 cases: Plantar flexion was present in 1, and absent in 1, 50 per cent. each.

Feigned aphasia, 1 case; Plantar reflex was R. absent, and L. Present.

Dementia, 9 cases: Flexion plantar reflex was present in 3,

33.3 per cent.; absent in 6, 66.7 per cent.; in one plantar reflex flexion was present on one side and all reflex absent on the other.

Melancholia, 12 cases: Plantar reflex was present and normal in 2, 16.7 per cent.; absent in 10, 83.3 per cent.

Imbecility, 1 case: Plantar reflex was absent, 100 per cent.

Idiocy, 2 cases: Extension reflex existed, 100 per cent.

Extreme degree of hydrocephalus, 1 case: Plantar flexion reflex was present, 100 per cent.

Paretic dementia: 4 cases: In 2 plantar reflex was absent; in 2 present on one side and absent on the other; absent 75 per cent.

Hip disease, 3 cases: Flexion plantar reflex was in all, 100 per cent., present 25 per cent.

Spinal rigidity, 1 case: Flexion plantar reflex was present. 100 per cent.

The following 450 cases of nervous and mental discases have been studied with especial reference to the Babinski phenomenon, in my office, in consultation practice and in attendance on private cases in St. Luke's Hospital, during the past eighteen months.

Tumor of the brain. 8 cases: Of these 3 tumors in pyramidal region, extension plantar reflex was present in all of affected leg. 100 per cent.; flexion plantar reflex was on opposite side in 2 cases. 66.7 per cent.: absent reflex existed on opposite side in 1, 33.3 per cent. Of 5 tumors outside pyramidal region. flexion was present, 60 per cent.: absent in 1 case. 20 per cent.; flexion was present on one side. absent on the other. 20 per cent.

These tumors are divided into two classes one which invades the pyramidal or motor region. and the other which does not affect this region, and the percentage is calculated in the one instance on the number of tumors affecting the pyramidal tract, which is 3, and in the other on the number without the pyramidal tract, which in this instance is 5.

Abscess of brain, 1 case: Plantar flexion was present, 100 per cent.

Meningitis, 30 cases: Flexion was present on both sides after coma in 5, 16.7 per cent.; extension on both sides in 5, 16.3 per cent.; flexion present on one side and absent on the other 3.3 per cent.; absent in 19, 63.3 per cent.

Epilepsy, 21 cases: Plantar reflex in 18, 86 per cent.; irregular in 3, 14 per cent.

Syphilis of the brain or cord, 20 cases: Flexion was present in 15, 75 per cent.; absent in 3, 15 per cent.; irregular in 2, 10 per cent.

Old hemiplegia. 30 cases: Extension reflex on affected side

in 25 cases, 83.3 per cent.; extension reflex on opposite side in 3, 10 per cent.; reflex absent on both sides in 5 or in 16.7 per cent. In the latter there were trophic changes in the paralyzed limb.

Bilateral thrombosis, 2 cases: Extensor bilateral reflex was in both, 100 per cent.

Posterior spinal sclerosis, 20 cases: Flexion plantar reflex was just perceptible, irregular or delayed in 14, 70 per cent.; absent in one foot and present in the other (flexor) in 2 cases, 10 per cent.; absent in both feet in 4 cases, 20 per cent.

Multiple neuritis, recent and old, 6 cases: Flexion was present in 2 cases, 33.3 per cent.; absent in 3, 50 per cent.; present in one foot and absent in other, 1 case, 16.7 per cent.

Anterior poliomyelitis (old and recent), 106 cases: Flexion was present in 6, 60 per cent.; present in one foot in 3 and absent in the other, 30 per cent.; absent reflex in 1, 10 per cent.

Pressure neuritis affecting sciatic nerve: 8 cases: Normal plantar reflex was present in all, 100 per cent.

Pressure neuritis of nerves of leg, 10 cases: Normal plantar reflex present in 8, 80 per cent.; absent in 2, 20 per cent.

Myelitis, 8 cases: Extensor plantar reflex was present in 50 per cent.; 4 dorsolumbar was absent, 50 per cent.

Complete transverse lesion of cord, 1 case: Plantar reflex absent, 100 per cent.

Spinal caries, 10 cases: with pressure on cord above, lumbar region 4 cases, extension plantar reflex in all, 40 per cent.; spinal caries without cord lesion, flexion plantar reflex in 4, 40 per cent.; spinal caries with cord lesion in lumbar region absent reflex, 20 per cent.

Paralysis agitans, 3 cases: Sluggish flexion existed in all, 100 per cent.

Hysteria, 10 cases: Flexion plantar reflex was in 5, 50 per cent.; absent plantar reflex in 4, 40 per cent.; flexion plantar reflex in one foot, absent in the other, 10 per cent.

Neurasthenia, 25 cases: Reflex was normal, but often almost imperceptible plantar flexion, including cases of increased plantar reflex, 23 cases, 92 per cent.; absent plantar reflex in 1 case, 4 per cent.; absent in one foot and present in the other in 1 case, 4 per cent.

Nervousness, to which name neurasthenia or hysteria can not be properly applied, 15 cases: Flexion was present in 14, 93.3 per cent.; absent in one foot and present in the other, 7 per cent.

Traumatism to head, with no gross lesions of the brain substance so far as I was able to detect, 12 cases: Flexion plantar reflex was present before shock had passed away in 10 cases, 83.3 per cent.; absent plantar reflex in 2, 16.7 per cent.; after

shock is over flexion plantar reflex was found in all, 100 per ment.

Traumatism to spine, with no gross lesion, 8 cases: Four cases with profound shock, plantar reflex was absent, 50 per cent.; 4 cases with minor shock plantar reflex was present, 50 per cent.

Dementia, 30 cases: Plantar flexion reflex was present in 11, 36.7 per cent.; absent in 15, 50 per cent.; extension plantar reflex in 4, 13.3 per cent.

Paretic dementia, 15 cases: Flexion plantar reflex was found in 14, 93.3 per cent.; absent in 1, 9.7 per cent.

Mania, 10 cases: Flexion plantar reflex was present in all, 100 per cent.

Melancholia, 22 cases: Plantar reflex was absent in 16, 72.7 per cent.; present, but irregular, in 6 cases, 27.3 per cent.

Paranoia, 15 cases: Flexion plantar reflex was present in all, 100 per cent.

Feigning, 4 cases: Flexion plantar reflex was in 3, 75 per cent.; plantar flexion was present in one foot and absent in the other in 1 case, 25 per cent.

Stuporous melancholia, 4 cases: Absent plantar reflex was in all, 100 per cent.

Melancholia attonita, 1 case: Normal plantar reflex was present, 100 per cent.

Weakmindedness, 10 cases: Flexion plantar reflex was present in all, 100 per cent.

Imbecility, 12 cases: Flexion plantar reflex was present in 9 cases, 75 per cent.; absent or irregular in 3 cases, 25 per cent.

Idiocy, 13 cases: Flexion plantar reflex was present in 6, 46.5 per cent.; absent in 4 cases, 30.5 per cent.; irregular in 3 cases, 23 per cent.

Deaf-mutes, 6 cases: Flexion plantar reflex was present in all, 100 per cent.

From a careful study of the literature of the plantar reflex, together with my personal investigations, I have to admit that the plantar reflex as found in children is unsatisfactory; and that the plantar reflex may be variable—irregular—absent in both feet, or absent in one foot and present in the other, more frequently than has commonly been supposed, especially by those who have not devoted considerable time to investigating this reflex in apparently healthy subjects.

It does seem to me that the claim of Collier, that ex-

tensor plantar reflex is present in total transverse myelitis, needs confirmation. Babinski did not obtain it. I have never found it in cases in which I could say that the cord was absolutely destroyed in any portion of its extent. It is not always easy to say when the cord is completely destroyed.

Langdon found the plantar reflex absent in tetanus. Collier found extensor plantar reflex present in a case of tetanus. This discrepancy between two good observers is easy to reconcile. In Langdon's case, the disease ran a rapid course and the patient died at the end of the third day, if I mistake not. Of course, the patient must have been greatly exhausted. I have found in all diseases with profound exhaustion that the plantar reflex disappears before death. In Collier's case the disease was milder, ran a slow course and the patient finally recovered. The lateral columns of the cord are probably in an irritated condition in tetanus until the stage of exhaustion is reached. The extensor plantar reflex is what we are prepared to expect in strychnin intoxication, or in fatal poisoning from this drug. This test may be of value in a diagnosis between strychnin poisoning and a hysterical attack simulating the drug poisoning.

I make this as a suggestion. May not a hysterical subject in a paroxysm so excite the pyramidal tract to such a degree as to render it possible for one to obtain a temporary or an irregular form of the Babinski phenomenon? In hysteria one occasionally obtains a quick extension of the great toe. It is soon exhausted and totally unlike the deliberate extension of the great toe found in the majority of persons suffering from disease of the pyramidal tract.

Giudiciandrea claims to have found extension of the great toe in hysteria and in normal subjects. Schüler obtained extension of the great toe in 8 per cent. of men and in 4 per cent. of women whom he examined.

Cohn states that he found extension of the great toe in 20 per cent. of his subjects. He also found extension plantar reflex on the affected side of a case of hysterical paralysis.

When I began to investigate the plantar reflex with especial reference to the Babinski phenomenon, I found extensor reflex in a number in whom I was confident there was no lesion of the pyramidal tract, and I began to be skeptical as to the value of the Babinski phenomenon. I soon learned to note the difference between the pseudo-Babinski phenomenon and the phenomenon described by Babinski in 1898. On re-examining these nervous and hysterical subjects, I did not find a genuine case of the Babinski phenomenon in which there were not other evidences of disease of the pyramidal tract.

You may ask me: Does the presence of flexion plantar reflex enable one to exclude disease in the pyramidal tract? I do not think investigation has gone far enough to enable any one to give a positive answer to this query. Personally, I do not remember having met with a case of disease of the pyramidal tract in which flexion plantar reflex was present on the affected side.

Diagnosis.—That the Babinski phenomenon is valueless in diagnosis, the most skeptical deny. In fact, Martin Cohn, who is often quoted as doubting the value of the reflex under discussion, is in some respects one of its firmest supporters. His conclusions are: "In the majority of all persons an irritation of the sole of the foot is followed by flexion of the toes. In lesions of the lateral tract of the spinal cord of an organic character, an extension reflex is to be observed." He then adds: "In no way, however, can this phenomenon be regarded as a certain pathognomonic symptom for the recognition of such a disease." [8] How few symptoms have we that are positively pathognomonic of certain lesions of any organ? It is only on account

of the number of irregular and unexpected results obtained by Cohn that most investigators of the Babinski phenomenon have come to look on Cohn as a skeptic.

A case presenting most of the symptoms of posterior spinal sclerosis would not be diagnosticated as a clean-cut case of this disease if the extensor plantar reflex were present. Such a reflex would probably show that the lateral columns were also diseased.

A case simulating strychnin poisoning, or tetanus, without great depression and absent extensor plantar reflex, would, in all probability, justify the diagnosis of hysteria.

Prognosis.—The Babinski phenomenon may have uses in prognosis. In the discussion on the conjoint papers, one by Walton and Paul, and the other by Fraenkel and Collins, presented to the last meeting of the American Neurological Association, Dr. Spiller said that "he believed in recent cases of hemiplegia in which the knee-jerk was found absent several days or weeks after the hemiplegia had developed and the Babinski reflex was present, prognosis was bad." [2] He admitted that he had observed only two cases that justified such a conclusion.

Prevention.—If it is found by subsequent investigators that persons following certain vocations attended with considerable exhaustion, the majority of these—as in the cases of the nurses reported by me in this paper—have absent plantar reflex and subsequently suffer from disease affecting the legs or feet, or the nervous tone more frequently than persons with normal plantar reflex, a timely investigation of the reflex may save many continuing too long in positions attended with great physical exhaustion. In fact it may be possible to judge by a study of the plantar reflex in many—especially in those whose plantar reflex is present when they are not exhausted—the degree of exhaustion from which they are suffering.

It is possible that much valuable information may be obtained by a further study of the plantar reflex, especially in the line of prevention, as well as in those of diagnosis and prognosis.

CONCLUSIONS.

1. The Babinski phenomenon is an extremely valuable sign in diagnosis, and probably in prognosis and prevention.

2. It is not a pathognomonic sign of organic disease of the lateral tract.

3. We shall learn by subsequent observations that several poisons or conditions so irritate the lateral tract as to cause a pseudo-Babinski phenomenon, or an apparently genuine one temporary in character.

4. Greater care should be used by the investigator, and the carefully studied cases should be much more numerous.

BIBLIOGRAPHY.

1. Brain, 1899, xxii, p. 78.
2. Jour. N. and M. Disease, July, 1900.
3. Brain, 1899, xxii, p. 75.
4. Jour. N. and M. Disease, June, 1900.
5. Babinski, Compt. Rend., Soc. de Biol., Paris, 1896.
6. Babinski, Semaine med., Paris, 1898, xvii, pp. 321-322 (quoted from article by Drs. G. L. Walton and W. E Paul. Jour. M. and N. Dis., June, 1900, p. 306).
7. F. W. Langdon, Cincinnati Lancet-Clinic, Feb. 17, 1900.
8. Jour. M. and N. Disease. February. 1900.

SOME ASPECTS OF MEDICAL TESTIMONY.

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Expert evidence in common with most branches of the law is undergoing a gradual development. As to medical expert testimony specifically, current literature and decisions abound (First) in criticisms upon its present defects, (Second) in remedies suggested for these admitted imperfections.

UNCERTAINTIES—CONTRADICTIONS—VENIALITY IN EXPERT TESTIMONY.

There is general complaint concerning the uncertainties and contradictions in medical expert testimony. And we constantly hear that it is venial; that experts hawk any needed professional opinion in open market and sell to the highest bidder; and that money can buy any expert testimony it may want. The result is a general and deplorable distrust of expert testimony. An eminent lawyer, in a recent discussion at a state bar association, speaking of experts in handwriting, said to another: "I wouldn't convict a cat of stealing cream on such testimony." The other replied: "Nor would I in an insanity case on expert testimony alone, give my neighbor's mad dog a bad name."

The justice or injustice of charges so easily made with apparent propriety, but whose truth can never be determined, must be considered in the light of human nature and of the character of opinion evidence itself. It is a

familiar fact that in their testimony as to the simplest transactions the best of witnesses disagree. *A fortiori* this must occur in expert evidence, and the pessimist must be hysterical who fails to recognize that all branches of testimony produced before courts are open to many criticisms made as though they were peculiar to expert testimony. Indeed, candor compels a recognition of the truth-compelling tendency of scientific study, in the high, moral fiber of the average medical expert witness in the ordinary case.

Mere disagreement of opinion of physicians is ordinarily no just basis for criticism. Consider, for example, the minuteness of the observations necessary in the sciences involved. Thus the corpuscles of human blood are said to be of a diameter of 1/3630 part of an inch, and the corpuscles of the blood of a dog 1/3629 part of an inch in diameter. How remarkable and suspicious it would be indeed if microscopists should agree. Particularly in nervous diseases discrepancies in testimony arise. In a recent case, the defense produced a letter from the plaintiff, in a personal injury suit, to a physician asking what symptoms he should feign in such a disease. The physician and ten of the first men in the local profession, backed by hospital records, testified that the man was malingering. The defense claimed that the letter was a forgery and produced only two experts who believed that his injuries were genuine. A verdict was rendered for the plaintiff. Within ten days thereafter the man died. There is still a dispute as to whether he died of dope or of disease. A new trial was granted because the physician against objection testified as to what the deceased told him concerning the accident by which he was hurt. The death of the plaintiff prevented any subsequent recovery.

But it must be admitted that there are cases in which it is difficult to find any justification for professional mistakes. In a recent California case, it was alleged a

passenger in the street-car was violently thrown against the seat and floor and sustained a concussion of the spine, rendering her a physical wreck. She was examined by half a dozen or more physicians. A number of these discovered a tumor which her family physician testified was four times as large at the time of trial as when it first appeared, and there was considerable dispute as to whether the tumor could have been produced by the accident. The jury brought in a verdict of $20,000. On the motion for a new trial it appeared that the plaintiff had given birth to a still-born child at full term and that she had not been affected with a tumor at all!

BIGOTRY AND IGNORANCE OF EXPERTS.

Another evil, of which the general community complains, is the bigotry and ignorance of medical experts. There exists a curious but authentic report of the trial of the Suffolk witches in 1665. Two old women were there charged with having bewitched several children. I quote from the report: "Dr. Feavor, a doctor of physic . . . being called, he saw the child in these fits but could not conjecture . . . what might be the cause of the child's affliction." Other witnesses were then called. "There was also Dr. Brown, of Norwich, a person of great knowledge. . . He was duly of opinion that the persons were bewitched." Sir Matthew Hale, certainly one of the greatest judges of the world, in charging the jury, said "that there were such creatures as witches, he made no doubt at all." Thus both the professions conspired to perpetrate a judicial murder.

We are all familiar with Prof. Eric Erichsen's theory cf traumatic cerebrospinal concussion, and with the subseqent abandonment of that theory in consequence of Erichsen's own investigations and the more advanced and scientific labors of the later neurologists.

Our little systems have their day,
They have their day and cease to be.

However, the acceptance of that theory led in fact to stupendous fraud. For it is estimated by competent authority that the railroad companies of England and America were thus robbed of a hundred millions of dollars.

But the current bitter denunciation of the medical profession for such errors is likely to be as unjust as it is intemperate. The glory of inductive sciences is their progress. It is a part of the halo encircling their triumphs that they have rejected the most cherished hypotheses when their falsity was demonstrated or their use as a means of investigation has ended. Most of the evils of this kind are unavoidable. They are the necessary incidents of the evolution of human society. They are the inevitable products of the development of scientific knowledge.

LEGAL RECOGNITION OF SCIENTIFIC PROGRESS.

The law was not at fault in recognizing the theory. It must and should enforce what is currently received and endorsed as true by the most eminent specialists and has the sanction of the best scientific opinion. It can neither wait for abstract truth nor devote uncounted days to the determination of the debated questions of science. Lord Bowen once said: "Courts of law and courts of justice are not fit places for the exercise of the inductive logic of science. Life is short; it is impossible to place endless time at the disposition of litigants; and the laws of evidence are based upon this very impossibility of prolonging inquiries to endless length. There is hardly a scientific theory in the world which if we were to examine into in the law courts might not take year after year of the whole time of a tribunal." The law should shun the curse of dogma. Indeed, one of the worst intellectual vices of which a court can be guilty is to establish rules of natural

science by rules of municipal law. What folly it would be to require men to look into law books for the final determination of the uncertainties arising in natural science or industrial arts. Such questions should be of free logic and pure science. They should be adjudicated by courts only through the best scientific opinion and except in the clearest possible cases not by legal precedents. More specifically, puerperal fever at one time in the history of surgery and under certain circumstances may be no evidence of negligent treatment. At another time and under different circumstances it may be some or *prima facie* or conclusive evidence of malpractice. It is not for the law but for medicine to determine such a problem. Similarly there is an insolence in certain judicial findings that hysteria has no physical basis, that there can be no recovery for traumatic neuroses except when based exclusively on objective symptoms. There are cases in which the views of a court as to how far syphilis is curable as a matter of law are at right angles with perhaps the best medical opinion on the subject. Should a court hold as a matter of law that the sclera can not be ruptured by a blow of the fist?

It can not be charged with candor that the law taken as a whole rashly accepts untried novelties in medical science. To this bears witness its conservatism with respect to the use of the X-ray. The possibilities of fraudulent defects and misrepresenting exaggerations in skiagraphs are fully recognized and guarded against. And even in those jurisdictions which have rejected the view of the Supreme Court of the United States that to compel the physical examination of a plaintiff in a personal injury suit is to authorize an assault on his person, there is grave doubt whether courts will compel submission to the examination by the X-ray until the harmlessness of that operation is more fully demonstrated. And under no circumstances will one so order

unless the request for such examination is seasonably made and the person desired to take the photographs be shown to have the necessary skill and experience.

SELECTION OF EXPERTS—FUNCTIONS UNDER THE CIVIL LAW.

The public in general and the medical profession in particular bring many indictments against the current method of the law as to the selection of experts.

To contrast the civil and common law rules of selection of experts may in this connection tend to clarify existing confusion as to the place of the expert witness at the common law. In many foreign countries, the judge who conducts the proceedings is the agent of the state and acts really in both executive and judicial capacities. This appears conspicuously in the selection, by the state, of expert witnesses in France, Italy, Switzerland and Germany.

More specifically, in France counsel do not address the witnesses directly. In the Dreyfus case, for example, Labori, who is perhaps the most distinguished cross-examiner in the Latin race, submitted his questions to the court. The court then determined what questions he would propound to the witness; the court, and not the counsel, put the question. The whole personal manner accordingly is the manner of the judge and not of the counsel, and it is a notorious scandal that the judge threatens and browbeats the witnesses and thus often enables the state to procure its own ends. This practice takes the conduct of the case out of the hands of counsel and puts it in the hands of the state in both civil and criminal cases. The French lay does not allow each side to call such experts as it pleases; accordingly, the court appoints inquisitors unless the parties agree. The report of such "inquisitors"—and they are rightly named—is not subject to cross-examination. Correspondingly, in Italy, the court appoints experts, but the parties have a right to bring their own experts into

court. A discussion as distinguished from an examination then ensues. Probably the most satisfactory system of this kind is worked out in Berne. There, in civil cases, on motion the court. after asking recommendations by attorneys, appoints three experts unless a smaller number is agreed on. The experts, having been sworn, make a report which is subject to explanatory questions designed to elucidate doubtful points, but not to cross-examination as it exists in the common law. In criminal cases the court appoints one or more experts. In Scotland the executive asserted itself along this line and "assessors" were called on to advise the court as a part of the court, not merely as witnesses.

FUNCTIONS UNDER THE COMMON LAW.

In England judicial proceedings were originally inquisitorial; the court was an arbitrator. It ascertained the facts as well as it settled the law. The struggle of the judiciary against the executive is familiar history. The jurors themselves were originally witnesses. It was about the thirteenth century that "they were not, and were hardly supposed to be eye witnesses." It was their duty to discover the truth. They did this in and out of court. Accordingly, they listened to what the litigants or witnesses said at large without oath. Torture was used as an engine of state but never became really an undeniable part of the ordinary machinery of the law. The judiciary for a long time remained subject to the executive and, if a jury did not do the royal will, the jurors were punished until a jury was found subservient. Thus, for the robbery of the merchants of Brabant and of the king's train, the jurymen who acquitted were sentenced to death as perjurors. Others were then sworn until a jury finally hung from thirty to one hundred men.

And is there a thoughtful man who has read without a thrill of pride in the evolution of our judicial system, Macauley's eloquent narrative of the seven bishops'

case, and his statement of the heroic opposition of the jury to the tyrannical oppression of the king?

The result in the common-law is a judge, cold and impartial; a jury unbiased and independent; counsel, members of the court, but distinctly advocates; and witnesses. However far this union may fall short of perfection, the deficiency arises from the infirmities of human nature and not from the inherent defects of the system itself. The medical expert is a witness, pure and simple. He is not an "assessor" nor an "inquisitor" nor a referee appointed by the court. It is not his function to determine the questions in issue nor to see that the truth prevails, that is for the judge and jury. He is limited to giving testimony within the rules of evidence, that is to say, to answer only the questions that are asked him, to answer them most simply with only what explanations are reasonably necessary. Very many physicians fail to fully appreciate this exact position.

It follows, in experience, that the expert is more or less of a partisan and becomes in a measure an assistant counsel. It is fashionable to violently denounce him in consequence until an intelligent and honest physician, although he may be somewhat carried away by the earnestness of his views, by his sympathy for the cause, and by his indignation as to the wrong he opposes and by the aggravation of opposite counsel, is often regarded as a most ignoble and detestable creature. But our whole system of trial is designed to help each side of a case to present that case in the strongest possible light. The judge and jury are not deceived by the partisanship of experts. And when the medical man oversteps, in the slightest, his strict professional capacity and takes any part in the controversy as to legal right, and becomes an anomalous mixture of claim agent, lawyer and doctor, his advocacy is, in the great majority of cases, fatal to his efficiency as a scientist. Accord-

ingly, while such loss of scientific disinterestedness is deplorable, it does not seem to deserve the extravagance of vituperation which is often applied to it.

RECENT DEFINITIONS.

The standard of the law as to who is an expert is vague and is not always natural.

Although, in common with most lecturers on the subject, I have ridiculed the uselessness of definitions in general, and of experts and expert testimony in particular, none the less the formulæ in this connection, of Mr. George Wharton Pepper (37 Am. L. Reg. N. S. 737) is so notable as to call for special attention and for commendation. A detailed discussion of the cases on expert testimony, of especial interest to physicians, will be found in the second volume of the "Proceedings of the Pan-American Medical Congress," p. 2172, and see Ohio, etc., Co. vs. Fishburn, 56, N. E. 457. A minister of the gospel is ordinarily, in the absence of special training and knowledge, not an expert on insanity. (Burt vs. State, 39 L. R. A., 305.) But a Catholic priest may be, inasmuch as he continually passes on questions of soundness of mind before the administration of certain religious rites. (Toome's Estate, 54 Cal. 569.)

When a medical expert is called upon in a case of malpractice, for example, his fitness is determined, not by his acquisitions or capacity, but by his "school." In one breath the law insists that it will take no notice of different schools of medicine, but will regard only truth and science; in the next, it recognizes all systems as legitimate but tests the liability, civil and criminal, of a physician, according to his professed and avowed system. If the defendant doctor practice the "botanic" system, he can exonerate his wrong by expert testimony of his fellow botanists. A homeopath's care is to be measured by the homeopathic standard. And the

propriety of a regular physician's conduct, including surgical cases, is to be estimated by men holding his professional tenets. Occasionally there is manifested a civilized tendency to independently assert the natural standard of logic and to test malpractice by the settled rules of medical and surgical science. But so long as medicine is practiced by methods so diverse, it would be practical folly to expose a conscientious and learned physician to ruin by testimony impregnated with the ignorance and prejudice of unscrupulous quacks.

The medical profession in particular objects to the current practice as to the direct examination of expert witnesses.

EXAMINATION OF EXPERTS—THE HYPOTHETICAL QUESTION.

The much-abused hypothetical question, if an evil at all, is a necessary one. Expert testimony involves two elements—knowledge of facts, and opinions thereon. That knowledge may be derived in four ways only: 1, where the expert has actual knowledge, as where he has witnessed the occurrence and treated the patient; 2, where he has heard all the testimony on trial; 3, where he has had it all read to him; and 4, where the facts are summarized in the question; that is to say, where they are stated hypothetically.

There are accordingly, only three forms of questions to be addressed to an expert: 1,the general question, which assumes as true what the witness knows, has heard in court or has read to him; 2, the hypothetical question pure and simple, in which all facts are assumed in the question itself; 3, the mixed question, which is partly general and partly hypothetical. It is a sound and general professional opinion that the hypothetical question pure and simple is the best form and often the only question permissible under actual circumstances. Cases of actual knowledge on the part of an expert form a small part of opinion evidence. The time of the witness

and the time of the court are likely to prevent alike the hearing and the reading of all the testimony. The practice of asking general questions assuming all the evidence is true, is subject to quite drastic criticism, for example, on the ground that the expert may not be accurate and complete in his memory of all the facts or he may not recall them as the jury does. (12 Harvard Law Review, 550.) And a general question, assuming all the evidence to be true, is manifestly improper where there is conflict in testimony. It is not the place of the witness to determine such contradiction; so to do is to usurp the function of the jury. It is pointed out, however, that the jury is not bound to accept the opinion of the expert and that therefore such testimony might fairly be regarded as error without prejudice. But there is danger that the jury and the expert may disagree; therefore this testimony is worthless. Besides, it is constantly improperly made the basis of unfair speculative embarrassing cross-examination. Accordingly, in all such cases—and they are the overwhelming majority—the question must be hypothetical. And necessarily the hypothetical question is necessary and is the only proper one where the witness has no actual knowledge and has not heard the testimony or had it read to him.

RULES OF DIRECT AND CROSS-EXAMINATION DISTINGUISHED.

The medical profession also in particular criticizes the current practice of cross-examining experts.

The position of an expert under cross-examination is, as a rule, uncomfortable in proportion to his dishonesty and inefficiency. The experience of a rabbit with a ferret glued to his neck, or of a beetle impaled by an entomologist, or of a dog in the tender mercies of a vivisectionist, or even of a civilian in Manila may be less distressing than the pillory of a quack by a potent

and relentless cross-examiner. The whole modern system of trial in the common law turns on cross-examination. That law follows the policy of the "open door," and the religion of the "open mind." It admits evidence with a minimum of *a priori* restrictions. The evidence so admitted is then to be weighed. Cross-examination is to evidence what demand and supply is to an article of commerce—it determines value. Accordingly much greater liberality is allowed in cross-examination than in direct. This must be so, inasmuch as to cross-examination the moral and the mental qualities of the expert, as well as his opinions, are in issue.

By way of simple illustration, a witness on direct examination should not be asked to define words that have a well-known and definite meaning, like monomania, but they may probably without error be asked so to define upon cross-examination. The expert, like any other witness, may be contradicted by showing that he has made inconsistent statements out of court. (Montgomery vs. Commw., 882, 509.) A witness may be asked to give an illustration of the case similar to the one in issue—as recurrent insanity—which had come within his own personal knowledge. (Leadue vs. State, Am. Reps., 638.)

The importance of this subject and a general observation that physicians do not clearly comprehend the difference call for some amplification. In direct examination where the facts are undisputed the hypothetical question should include substantially all material facts, and the witness in answering should consider them all. Neither party has a right to disregard an important undisputed fact for any reason, as that its insertion may vary the answer or opinion of the witness to the prejudice of such party. Where, however, there is conflict in testimony the question must be based on facts which the testimony tends to prove. It need not then be based on all the evidence. The questions need not be confined to

conceded facts, but they may be based upon any assumption of facts which the testimony tends to prove regardless of the preponderance of evidence on the subject. But such questions can not assume facts of which there is no evidence tending to prove. They are limited to the assertion of such facts as counsel may fairly claim are justified by the evidence in the case. More specifically, when criminal responsibility depends on the sanity of the defendant, the court will not allow hypothetical questions which assume that a delusion existed in the mind of the defendant when there is no evidence tending to support the assumption. Counsel, in other words, put questions which assume facts favorable to their respective contentions. The jury determines which contention is correct, and on request the court should specifically charge the jury to carefully consider which assumption of facts is sustained by the evidence.

The rule is otherwise on cross-examination. To test the skill and accuracy of the expert, counsel may, on cross-examination, ask hypothetical questions pertaining to the inquiry but assuming facts having no foundation in the evidence. In direct examination the hypothetical question can be based only on actual facts; in cross-examination there may be hypothetical questions based on hypothetical facts. Thus, whether certain hypothetical facts would indicate insanity may be asked on cross-examination to test the competency of an expert. Again, in direct examination, "After a witness has once qualified himself as an expert and given his own professional opinion to that which he has seen or heard upon hypothetical questions, then it is ordinarily opening the door to a too wide inquiry to interrogate him as to what other scientific men have said upon such matters or in respect to the then general teachings of science thereon or to permit books of science to be offered in evidence. Mr. Justice Brewer, in Davis vs. U. S., 165 U. S. 373 (1897). But, on the other hand, in cross-

examination the whole range of scientific literature may be used to confound the expert.

CROSS-EXAMINATION IN DIAGNOSTIC NEUROLOGY.

Dr. Eskridge's paper suggested to me, while his singularly clear demonstrations were being made, how completely the literature of the medical profession supplies unfailing means of establishing science and truth and of demonstrating the ignorance, dishonesty or inaccuracy of the medical expert witness, even in cases of the most extreme difficulty, viz., of diagnostic neurology. Suppose a plaintiff in a personal injury case has been actually examined in the presence of other witnesses, by the expert being cross-examined; suppose also that the expert has failed—as often happens—to have clearly in mind a definite classification of the deeper and of the superficial reflexes. He is likely to be confronted by counsel fully equipped, who, for example, may have tried many such cases, on the simple and admirable classification of Professor Ross. More specifically, if that expert has failed to test the abdominal reflex, he may be confronted with the opinion of Rosenbach, that this reflex is lessened on the paralyzed side in the disease of one cerebral hemisphere. Or, if the expert has neglected to have the cremaster reflex tested, then he is likely to have counsel face him with Jostrowitch, to his consternation. Or, if he has overlooked any of the delicate but clear observations and tests of the plantar reflex, he may be pulverized by Dr. Eskridge's immediate contribution to scientific learning. So, if he has made any general or special omission, he may be called to account unerringly by the general opinions and authority of Horatio C. Wood, Gray, Cohen and other authorities.

No doubt cross-examination is abused. A court should not allow itself to be converted by skilful cross-examination into merely a place for the exhibition of dialectic skill. But it should do nothing to save the

knave from exposure or the charlatan from his own confounding. The ability of an ordinary witness to lie as to facts, and the inability of counsel on cross-examination to detect and demonstrate his falsity, I believe to be much greater than that of the medical expert to distort symptoms and misrepresent his science.

ANSWER BY EXPERTS.

It is usually the bar which finds fault with the answer of the medical expert.

As to such answer, it is important to bear in mind that the expert should limit his testimony to the facts stated in the question put. He may feel that the question is unfair and does not reproduce the case in question, but its propriety is for the court to decide. There are many questions he can not answer with certainty. In such cases he should be careful to express a qualified opinion only. It is of the utmost importance to him to avoid speculations, digressions from the question asked and not to volunteer testimony. The lawyer is a trained dialectician, and the best of medical experts rarely is. The counsel's blade, like the surgeon's knife, may be wrongly and dangerously used. but it behooves the expert to see that he is not made its victim. For example, Sir Henry Hawkins, before he was elevated to the bench, in the trial of the Tichborne case, was engaged in a discussion with Dr. Kenealy, as to the ability to render English into French and French into English. The Doctor asked whether the counsel thought the French word *canaille* had its precise equivalent in English. "Oh, yes; Kenealy, is the English equivalent," the advocate at once replied.

An expert should exercise particular care never to answer a question which involves the determination of conflicting testimony. As has been shown, this is for the court and jury. Most painful embarrassment is likely to follow such an answer on cross-examination. But, for example, the negative answer of an expert

witness to a question as to whether, on the day of the execution of his will, such testator was or was not "laboring under an insane delusion, or anything of that kind," is not objectionable as being a satement of fact, and not the expression of an opinion. And in this connection, no expert can with safety ignore the reiterated caution in dialectics, not to be made the victim of the "Socratic method" by answering yes or no to a question which is not properly susceptible of a categorical reply. The familiar dilemma of that logician will illustrate this. He asks: "Have you left off beating your mother-in-law?" If the unwary replied "yes," the retort was, "Why did you beat her?" If the reply was "no," the retort was. "Then why do you not stop?"

TREATMENT OF EXPERTS BY COURTS.

A very popular evil of expert testimony, of which the community, the medical profession and counsel all complain, is the conduct of the trial and the rulings of the courts. The court can secure the orderly conduct of a trial and can reprimand or punish an impudent witness by fine or imprisonment, and it often happens that a court may save the feelings of a witness and preserve its own dignity where cross-examination is abused. Correction may be jocular: Baron Alderson, for example, once said to a lawyer, after a course of successful but badgering cross-examination, "Really. you seem to think the art of cross-examination is to examine crossly." Correction may be severe: Mr. Chief Justice Dallis said to some witnesses decrying medical authorities, "I will not sit here and hear science reviled by ignorant tongues." Correction may be practically impossible: Indeed, ordinarily the protection of the court is no shield against the shaft of wit. In a celebrated case a witness was asked the precise distance between two points involved in the issues on trial. He stated it definitely. "Are you sure? Positive? Why?" "Because I thought some fool like you would ask me."

In its rulings the court often treats the testimony of experts with a patronizing and aggravating approval or disapproval. Thus, after having received expert testimony, which is really a confession of its own ignorance and of the necessity of its own instruction, it will—loftily—charge the jury that they are not bound by the opinions of expert witnesses, but that they may disregard all or any part of such opinions as appear to them to be unreasonable. The court may weigh the relative merits of experts and announce the opinion, for example, on a medical subject, of a medical man of small experience or who has crude and visionary notions or who has some favorite theory to support, is entitled to very little consideration. And it may hold that if the reasons assigned are frivolous the opinion of the witnesses are worth nothing. Not infrequently it will set aside a verdict, although supported by opinion evidence when that verdict is inconsistent with undisputed facts or reason and common sense applied to other credible evidence. In French vs. State (93 Wis. 325), the supreme court of that state whose decisions, by the way, physicians and residents therein must come to regard as medical authorities, the court held inadmissible the testimony that a man suffering from delirium tremens has no more control over his actions in that respect than a man suffering from delirium produced through any other cause, but that he is still sane. This was held to be directly opposed to the established legal rule on the subject. But, on the other hand, if the verdict, for example, in a mal-practice suit, disregards expert testimony and is in contravention of good judgment, that verdict will be set aside.

TECHNICALITIES OF THE LAW.

One evil of which the public justly complains is that cases involving expert testimony are too often not tried on their merits, but determined in many instances merely by technicalities. Here the law rather than

medicine is at fault. More specifically, of the cases reported in the general digest of 1894, 48 per cent. of the points submitted to courts of appeal were on pleading, practice and evidence generally. The vigorous protest of the community, and especially of the bar, constituting indeed almost a storm of indignation, resulted in a reduction of about 25 per cent. in 1895.

In New York in particular, the fact that profitable costs may be taxed upon practice motions has carried this abuse of the law to a most deplorable and humiliating state of degradation. In England, *per contra,* it is said that no recent case can be found in which a trial court has been reversed on a mere point of practice. Fortunately the tendency in our own jurisprudence is in this direction. The Supreme Court of the United States leads in this direction—as where it has rejected supposed errors in expert testimony founded upon the familiar objection to the leading question and to hearsay evidence.

REMEDIES—SUGGESTED.

Many remedies have been suggested for the real and imagined evils of medical testimony. In the first place, there is from time to time a general movement toward a statutory designation of a medical board with suggestions of all gradations of power. Thus there is the proposition that experts be appointed by the court to investigate the case in issue as an expert accountant would examine books or a master in chancery would make findings. It is suggested sometimes that such findings should be subject to judicial review and also sometimes that the experts be required to be present in connection with their report, for examination, and that in the discretion of the court further proof be allowed. But it is vigorously urged, on the other hand, that such report should establish facts and should be final in its nature and conclusive upon the court. It is manifest that all propositions of this kind are likely to fail of

effect because of their unconstitutionality, the multiplication of such boards in all departments of opinion testimony and of the intrinsic difficulties in the selection and conduct of such a board. The bar will rarely favor any restrictions on the fullest opportunity to test evidence and to prove the truth.

Of course, where the judgment is by default as distinguished from cases where issues are joined and litigated, the court may appoint a referee to hear and determine. This was done in the celebrated mal-practice and blackmailing case brought against Dr. Sears. The plaintiff abandoned his case. Thereupon, on application of the defendant, a master was appointed who took testimony and reported a judgment in damages of $20,000 in favor of the great physician. And in the ordinary cases of insanity where there is no contest a small board of physicians determines the questions in fact although in form its conclusions are usually only advisory.

In the second place, a more reasonable class of proposed legislative remedies is based on the principle of making the expert fee a public charge, as by fixing the legal rate to be paid by the state and excluding from testimony any person receiving or expecting anything from the parties. In 1898 the New York Bar Association and three medical societies recognized by the law in that state approved of "the appointment of expert witnesses who must qualify themselves to give opinion evidence in cases without consultation with the litigants or their counsel and who shall be compensated for their services out of the county treasury of the county in which the trial takes place." The measure has never become a law, and probably never will. An additional suggestion is made that the statute provide for charging to the public the fees of experts on whom the parties may agree, but not compelling them to select such experts. The practical effect of such a law might tend to

increase litigation; it certainly would not meet the cases where much money is objectionably employed in lawsuits. In the third place, it is a happy augury for the future to note a general tendency to require that the standard of practitioners of medicine be raised by statute, that while that standard recognizes no school, it requires a specified number of years of study and a higher degree of professional knowledge and of professional character. Expert testimony should be given by such persons only.

The average member of the bar has as little confidence in the average statutory enactment as the physician has in a new-fangled specific or a patent-medicine cure-all. The moral and intellectual elevation of the medical profession and of the profession of law is likely to accomplish more than all else combined to alleviate these wrongs; and the various medical associations throughout the country, and academies like this, which bring thinking men of both professions together, and which increase reflection and stimulate *esprit du corps,* are of more moment and promise more for good than all the sessions of the legislature. Along this line I beg to submit this further suggestion. At a meeting of the American Bar Association, in 1898, Mr. Justice Brewer read a paper on "A Better Education the Great Need of the Profession." He was followed by Dr. N. S. Davis, of Chicago, on "The Importance of the Study of Medical Jurisprudence by Students of Law." Every gentleman present must agree with the observations of courts and of counsel themselves that it is a rare thing to find a lawyer who can adequately examine and cross-examine a medical expert. I respectfully submit that a theme well worthy of the consideration of all men interested in the professions, and especially of men connected with schools of medicine and of law, is the importance of the study of medical jurisprudence by the students of medicine.

STUDY OF MEDICAL JURISPRUDENCE BY DOCTORS.

Would it not conduce to professional advancement that a lawyer should lecture to doctors and a doctor to lawyers on this general subject? Professional ethics would be enforced by reiteration as well as by statements from different points of view. A physician who goes upon the witness-stand for the first time, without any preliminary knowledge of the rules of evidence, and especially as to the practice concerning examination and cross-examination, is often in a most pitiable position. A little elementary study might save him from humiliation and professional depreciation. Such a study would prevent a physician on the witness-stand rendering valueless his testimony as to the worth of his brother physician's services, because postulated upon the value of the estate of the deceased patient. A little knowledge might prevent his being subjected to the current embarrassment arising from his misapprehension as to the extent of his testimony when he is called upon to testify in a case which he has treated. The inexperienced physician, supposing that his examination will be limited to the facts and that he will not be called on to testify as an expert, constantly finds himself exposed to withering cross-examination on the whole medical subject involved. (When physicians testify as to matters within their own knowledge concerning the particular case, as where they have attended a patient, they are not entitled to expert fees and are not compelled to answer expert questions. Where they have no such knowledge but testify in answer to hypothetical questions or upon parts of the testimony which they have heard, they are entitled, in most jurisdictions and according to the best but not the universal opinion, to expert fees, and of course give purely expert testimony. The line of demarkation between the two classes of cases in the nature of things is not clear or distinct. When a physician has attended a case, testimony, in both examination

and cross-examination, it must occur that general questions will be asked as to the propriety and probable result of his own treatment. Moreover, it is the function of cross-examination to determine the credibility and competency of a witness, especially of a professional witness. Accordingly, within limits, the physician is compelled to answer such general questions. Such limits depend largely upon the discretion of the trial court. But it is a safe rule for a physician in such a position to prepare himself for a searching exploration into his knowledge and capacity on the subject involved in the treatment of the case. If the ordinary and logical limitations of such examinations are, however, largely exceeded, he should apply for and is often granted expert fees.) The legal knowledge would be of great professional use in a general way, and might spare physicians damage suits, for example, where they have allowed a layman to be present at an operation on a female patient. They would be advised how justly and efficiently to secure the preference due to professional services rendered during the last illness.

CONCLUSION.

In conclusion, these propositions are submitted, "not dogmatically for acceptance but tentatively for consideration," viz.: 1. Evils exist in medical expert testimony. They are many, they are great, they are partially the fault of the profession of law and partially of the profession of medicine. 2. Many of these evils are necessary and inevitable, arising in part from human infirmity and in part from the nature of opinion evidence itself. 3. Taken as a whole medical expert testimony is as satisfactory as any other human testimony introduced under our present rules of evidence. 4. For these evils there is no specific remedy, but the hope of improvement is not an iridescent dream.

COLLABORATION BY LAWYERS AND DOCTORS.

A distinguished American scholar and lawyer, Mr.

Persifor Fraser, has eloquently expressed his dread of interference in the development of this branch of the law by persons outside of the profession. He said: "The common law, which has been found on the whole to yield such good results in the hands of the Anglo-Saxon race, has grown like the palace of St. Mark by successive additions and patches. Much of its structure is composed of conventional usages and interpretations of which the lay mind is ignorant, and yet these parts have a strength like that of a 'built-up beam.' . . . There would be great danger in allowing one ignorant of the history of the law and of the significance of its formulas to insert a new part among its venerable timbers lest some of its strongest spikes that bind the latter together should be displaced and the whole structure tumble. Exclusively to the juris-consult, therefore, belongs the task of formulating the law governing the preservation of expert testimony." But is it not a wider and wiser view that both lawyers and doctors shall be the jurisprudents who shall do this great work; that the thoughtful and aspiring men in both the professions shall collaborate upon this particular niche in the temple of justice? They can be such artificers, having deep in their purpose this sentiment of one of the most eminent of our jurists: "Justice is the greatest interest of man on earth. Wherever her temple stands, and so long as it is duly honored, there is a foundation for social security, general happiness, and the welfare and progress of the race. Whoever labors upon this edifice with usefulness and distinction, whoever cleans its foundations, adorns its entablatures or contributes to raise its august dome still higher in the skies, connects himself in name and fame and character with that which is and which must be as enduring as the frame of human society."

KELOID FOLLOWING TRAUMATISM.

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Keloid, a term first applied by Alibert in the year 1814, to a pathologic condition known as an overgrowth of scar tissue, was so named by reason of its resemblance to a crab. The term is also applied to apparent fibrous outgrowths of the skin of a similar character, formerly believeed to be of spontaneous origin, but now the theory is accepted that they are results of lesions in the skin. This is said by some authors to be a somewhat rare disease and affects the colored races more than the white. It is commonest in middle age, but may occur in any age of life. Its favorite sites are the anterior superior sternal region, the shoulders and the neck, but may occur on any part of the body.

The so-called keloid of Addison forms contractions of the skin and the fasciæ, thus giving a hide-bound appearance to the part. It rises from no other perceptible causes than cicatrices or other injuries to the skin. Sometimes the growth is imbedded in and on a level with the surface of the skin, but more frequently it is elevated. It is very firm in its consistency and usually remains permanent through life. There has been an attempt by some authors to classify these growths as true and false in accordance with the manner in which their origin seems apparent. But such differentiation

is not of clinical value nor is it of any consequence, as it is true that the histologic and anatomic elements are the same in each class.

The growth, in its incipiency, appears to be a flattened and firm, though somewhat elastic thickening of cicatricial tissue. It may cover a very small area of the surface of the body or may assume mammoth proportions. The surface of the growth is frequently a bright-red color or a pinkish hue, but sometimes paler than the surrounding skin. It is usually covered by a thin, smooth, and shining layer of epidermis, which is frequently easily detached. It is often painful on pressure, but may be entirely painless. The crests of the angular ridges over the surface of the tumor often have a tendency to ulcerate and bleed readily.

The rapidity of the growth is by no means symmetrical in all cases; sometimes its development is very slow, while in others it arises phenix-like and covers a large portion of the skin in a very short time. In a case of very severe burn or other severe injury the growth may or may not occupy the entire cicatricial surface. It is not uncommon for a growth of this character to make its appearance in the line of coaptation of the flaps after amputation and this form usually presents the appearance of a red, shining nodule, with an irregular surface, and from the base of the tumor various sized ramifications are seen extending into the healthy skin. This gives the base of the tumor an irregular, serrated, circular appearance. Keloids are most frequently found following wounds that covered over a large area and have healed by granulation with suppuration. The growth occasionally will have a rough, warty and sometimes scaly appearance with the base having a decidedly irregular outline.

The same person may have as high as twenty or thirty growths or may have but one. They are, however, frequently multiple and always non-symmetrical in size.

B. Farquhar Curtis, of the New York Post-Graduate School, reports a case of a negress whose entire body was covered with apparently normal cicatricial tissue and presenting some of the usual characteristics of keloid. Hays reports a similar case.

KELOID GROWTHS.

It has been the observation of the author that both sexes are equally liable to attacks of growths of this kind and an apparent hereditary tendency has been noticed. In fact, families who have predisposing ten-

dency to abnormal growths are often victims of the disease. It may occur in several members of the same family. The disease is not alone confined to the skin, but has been observed on the conjunctiva and even has been known to develop on the tongue as well.

The microscopic examination shows a more or less characteristic differentiation of these tumors with regard to their being of a special kind. They are made up of true cicatricial tissue composed of bundles of interlacing white muscular fibers running horizontally just below the upper surface of the corium. Keloid as a rule is devoid of papillæ, but if they are present they are usually perfect. The growth sometimes, however, infiltrates the corium and destroys the papillæ by pressure from beneath. In keloid which follows in the wake of a large wound, papillæ, sebaceous glands, and hair follicles are not present. The blood-vessels of and even beyond the margin of the growth show definite changes. They are surrounded by round cells which form a part of the adventitia. Fusiform cells are also found in close proximity to the vessels. Warren says that the keloid begins by a growth of round cells in some adventitia of the arterioles of the corium; these cells often becoming fusiform, finally developing into fibers and forming the tumor. Though the tumor may occasionally have a sarcomatous appearance it is not usually hard to differentiate keloid from other tumors of the skin or mucous membrane, as keloid has the characteristic cicatricial appearance, the irregular margins and the claw-like projections from the center of the growth into the healthy skin. Another point of differentiation is the tendency to recur after excision or apparent extirpation. In keloid proper the bundles of white fibrous connective tissue run parallel with the length of the growth.

Surfaces that have been denuded of skin or even deep integument by corrosive acids or alkalies are not un-

commonly the sites of these growths. In fact, surface wounds of any description may give rise to the origin of keloid proper. There is no apparent specific reason given for the enlargement of cicatrices, but it is believed to be due in many cases to constant irritation of the surface.

Keloid, when located over a movable point, will often impair the motion of the member. It may encircle the mouth, nostrils, ear, eye, or any orifice of the body, and thus to a greater or less degree, impair the use, if not destroy the function of the member.

Some authors believe the growth to be of microparasitic origin.

Treatment.—The treatment of these tumors is very difficult. If complete excision is practical, a cure is imminent, yet the same predisposing tendency may promote the production of the second growth that was present in the first, and there may be a recurrence in the new scar where previous extirpation was apparently complete.

The Thiersch method of skin grafting is often successful in avoiding recurrence if excision has been complete. Scarification is worthy of consideration and in fact is often successful. The following method is commendable: Make parallel incisions over the surface of the growth the full thickness and about four lines apart. The incision should extend a short distance into the healthy skin. Cross incisions should be made likewise. For reasons apparent, in order to facilitate the operation, an ethyl chlorid spray should be used until the growth is completely frozen. Not only does this alleviate the suffering attendant on the operation, but the devitalizing effect of the process of freezing has a tendency to retard cellular activity and thus assist in arresting further development of the growth. The use of cocain for an anodyne is also commendable.

Electrolysis is recommended by Hardaway. This is

accomplished by making numerous punctures in the surface of the tumor and also the surrounding skin with the needle. Care must be exercised that an extraordinary amount of electrical application may not set up an irritation and thus produce an increase in development of the growth. Firm or elastic pressure will sometimes tend to produce atrophy and thus lessen the size of the growth.

The constant application of flexible collodion, owing to its power of contractility, is said to be of benefit in reducing the growth.

Complete excision is the most rational treatment when practical, but care should be used that the flaps should be properly coaptated or, if this is not possible, the denuded surface should be thoroughly covered with skin graft.

CASE 1.—A. D., a railway fireman, aged 22, a native of Ohio, of German descent, gave a negative history of specific disease. His health at the time of the accident was good, and his weight about 160 pounds. About January 13, while coaling an engine, as he opened the door the crown sheet gave way and gave vent to a terrific escape of steam from the boiler. He was severely scalded about the head and face, neck, shoulders, anterior surface of the chest, arms and legs. Some of the burns were of the third degree. Following the burn there was a large amount of devitalized tissue detached. About June 1 he passed from my notice with the wounds healed, and his condition fairly good.

About July 1 I casually stopped at his residence and found that on the anterior surface of the right arm a keloid growth had made its appearance. It was irregular in outline, its longest diameter from above downward was about six inches and the shortest diameter 2½ inches from side to side. The growth had the characteristic deep-red color and general appearance of keloid. The keloid did not cover all the surface of the arm that was burned over, but some of the claw-like projections extended into the healthy skin. The growth was firmly set in the skin and subcutaneous tissues, and elevated above the surface, at the highest point near the center about one-half inch. At several points on the crest of the keloid were small granular, ulcerating patches that were ready to bleed on the slightest disturbance. The patient complained of intense itching, especially at night. There was some contraction

of the tissues between the shoulder and the elbow, sufficient to hold the arm in a semiflexed position. This I had not noticed during his convalescence. He complained of a slight pain and some stiffness of the muscles at the site of the growth. The burn in this region, as I remember, had extended down to the muscles. There were several small keloids near the elbow and on the outer surface of the forearm, having the same characteristic color as the one described. They were non-symmetrical in size and form, the largest one being about one-half inch in its longest diameter.

The patient has resumed his employment. The disability produced by the stiffness and contraction caused by the growth is not sufficient to interfere seriously with the use of the member.

CASE 2.—A mulatto girl, aged 15, a domestic, received a severe burn at the age of 12, over the outer and anterior aspect of the shoulder. About one year afterward, in the same region, a keloid developed that measured about three inches from above downward and 2½ inches from side to side. Complete excision of the growth and thorough coaptation of the skin with healing by first intention proved to be successful in eradicating the growth, and there has been no return. There was no history of syphilis.

CASE 3.—Mr. A., a railroad fireman, about 30 years of age, was successfully vaccinated in December, 1899. At the site of the scar a keloid developed, oval in form, with regular outline measuring one inch in the longest diameter from above downward, from side to side three-fourths of an inch. The surface was elevated above the surrounding skin. The growth was a bright-red color and nodular, with small ramifications between the nodules and some extending into the healthy skin. Complete excision of the growth followed by coaptation and primary union was successful in this case and there are no signs of return. Prior to the excision the patient complained of stinging pains and occasionally itching sensations about the growth, especially after a hard day's labor. He also complained of some stiffness of the arm and inactivity of the muscles in the region of the growth.

CASE 4.—Miss B., a ballet dancer, by some means came in contact with a natural gas fire, producing burns of the third degree on the posterior aspect of each leg, covering the entire surface from the hip to the ankle. Shortly after a very tedious healing by granulation, keloid occupied the greater portion of the cicatrices. The stiffness of the muscles, with the impaired motion of the knee-joint produced by the growth, owing to its firmness and contractile power, impaired the use of the members to such a degree as to cause her to abandon her profession. At the posterior surface of the knee-joint the

motion of the knee kept up a continuous irritation of the abnormal tissues and there was an occasional fissure developing at this point, until she died with pulmonary tuberculosis three years afterward.

SURGICAL SHOCK.

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Shock is a condition of sudden depression of the whole of the functions of the body, due to powerful impressions upon the system by physical injury or mental emotion. Its more obvious manifestations are lowered activity of the cardiac, respiratory and sensory functions. The symptoms of shock may present all degrees of gravity, from profound collapse quickly succeeded by death to a mere temporary impairment of mental vigor, with transient diminution of muscular energy and a slight irregularity of the heart's action, signs which it is very hard to distinguish from syncope, if, indeed, it is possible.

As shock is a disordered function and due to no structural change, its pathology is obscure and difficult to determine. The term "shock" has been employed indiscriminately to describe all cases of sudden death following injury without hemorrhage, and in which post-mortem examination failed to reveal any visible or adequate cause. As accuracy of diagnosis has increased, many cases formerly classed as shock have been eliminated, and opinions as to the pathology of true shock have crystallized into two leading theories, based on certain functional disturbances in the vascular and nervous systems, respectively. One of these theories is

that the phenomena of shock are produced by the suspension of the nervous power, manifesting itself through the circulation, resulting in paralysis of the heart and abdominal vessels, and of the whole vasomotor system. The great mass of blood stagnates in the abdominal arteries and veins and the heart muscles are insufficiently supplied with oxygen and are unable to force the small amount of blood through the empty vessels.

The other and better theory, which seems more fully to account for all the phenomena of shock, is that it is due to irritation of the peripheral ends of the sensory and sympathetic nerves and a general functional paralysis of the nerve centers, both spinal and cerebral, which causes arrest or enfeeblement of the cardiac action and disturbed respiratory action. Death from shock may be immediate and result from cardiac arrest. Post-mortem examination of these cases usually shows the right cavities of the heart and great venous trunks distended with blood.

The symptoms of shock are of two general kinds, those due to a stunning or blunting of the vital powers, and called torpid shock, and those attributable to mental terror or agitation, and called erethistic shock, or prostration with excitement. As types of these two classes I desire to present two cases strikingly similar as to character and extent of injury, and yet showing the most marked contrast in symptoms.

The first of these was a woman, 19 years old, injured in a gasoline explosion. The patient lay conscious, yet dazed, seeing with the eye, but apparently failing to perceive with the brain; hearing, but not heeding, or replying only to loud and persistent questions; the eyes dull, vacant, motionless; the face animated by no expression, but pale and bathed in cold, clammy sweat; the features contracted, the finger-nails blue, the body and limbs occasionally convulsed by a shiver, the pulse irregular and very rapid, the respiration slow and ir-

regular, deep sighing inspirations, alternating with shallow and scarcely audible ones. Her temperature was 2 degrees below normal. Reaction could not be induced, and death occurred in five hours, the patient having merely "paused in the act of death."

The second case was a man, 21 years of age, scalded by steam from a locomotive in a railroad wreck. There were the same physical signs of shock as in the torpid case, so far as pulse, respiration, pallor and coldness of the surface were concerned. In addition there was the most extreme and unceasing restlessness and excitability. The patient tossed wildly from side to side, complaining of a fearful oppression and want of breath, shouting in the most piercing tones, and using the most profane and obscene epithets, with a countenance expressive of intense anxiety and the keenest agony. Consciousness seemed unclouded, but preoccupied by the mental and physical anguish, questions being answered, if at all, in a loud and angry tone, the intervals occupied with moaning exclamations. There was burning thirst and fluids were swallowed eagerly. In short, this case well illustrated the comprehensive description of Gross, who says that in shock "the machinery of life has been rudely unhinged." This condition persisted in slowly lessening intensity for twenty-four hours, when reaction was fully established.

From ordinary uncomplicated shock recovery is usually complete. Occasionally, however, a permanent impairment of health follows, as in a case coming under my care in which a man of 35 years was entangled in a coil of live electric wires. Shock was decided, but not profound, and recovery seemed perfect. The patient, however, soon began to show a change of disposition. Formerly cheerful, amiable and kindly, he became moody, sullen and uncertain of temper, and in an attack of pneumonia some ten months later developed homicidal tendencies, and died in acute mania. In this case,

doubtless, organic change of the nerve centers had supervened.

A predisposition to shock may exist in persons of sensitive nervous disposition or in the subjects of organic disease, especially of the heart or kidneys.

In those cases of sudden death, formerly classed as secondary or delayed shock, cases in which an interval of hours or even days has elapsed after an injury or an operation without the appearance of any untoward complications, some other explanation must be sought. No theory of nerve injury remaining latent for days and then suddenly manifesting itself with such violence as to terminate life in a few hours, is sufficient. The explanation may be found in pulmonary edema, or in renal congestion, pre-existent or developed as a result of an anesthetic, in concealed hemorrhage or in septic collapse from the sudden absorption of poisonous matters by a large serous surface, such as the peritoneum. Or it may be found in fatty embolism, that is, embolism of small arteries of the lungs, and very commonly of other organs, due to minute drops of fluid fat, which, having been set free somewhere in the periphery—generally in connection with the medullary cavity of bones—are carried into the circulation and follow its ordinary course. It is not easy in all cases to account for the force which is necessary to cause the oil drops to enter the veins. Sometimes the nature of the accident itself will give a reason for it, in the crushing or laceration which includes bones, muscles, subcutaneous fat and vessels alike. In other cases it has been suggested that the liquid fat from the broken-down cells stagnating in a wound is suddenly caught up when the stage of syncope passes off and the heart recovers; or it may be that from the commencement of inflammation there is a sudden increase of pressure and local tension. In these cases the patient may after the accident experience primary or true shock, or may appear perfectly calm and

unaffected, his pulse and respiration may be normal and there may seem to be nothing wrong, but after some hours or days the pulse becomes quicker and softer, the eye bright and restless, the respiration embarrassed, the extremities cold and exhaustion or coma and death may supervene. A brief history of a recent case will illustrate:

The patient was a man, 25 years old, five feet seven inches in height, weighing 180 pounds and presenting an appearance before the accident of perfect health. He fell, unnoticed, from the platform of a passenger train moving at the rate of about fifteen miles an hour; was found within five minutes after the accident, and at once removed on a stretcher to his home, about one-third of a mile distant. A simple oblique fracture of the left femur, at about the middle of its shaft, was the only injury found. Shock was marked, though not extreme. Some rigors and vomiting occurred and the heart was weak. Heat was applied and a hypodermic of morphia and strychnia and a small amount of whisky were given. Reaction was soon established and the fracture was reduced and dressed. The patient passed a good night and seemed to be doing perfectly well in all respects. About fifteen hours after the injury he began to be drowsy, and a slight but persistent cough developed. Soon the pulse increased in frequency and the respiration showed slight embarrassment. These symptoms, except the cough, grew steadily worse. He roused with more and more difficulty, and less perfectly, until in four hours coma was complete. The pulse became very rapid and irregular, the respiration became stertorous and finally assumed a Cheyne-Stokes character; the surface of the body became cold and cyanotic and, twenty-three hours after the accident, the patient died.

At the autopsy fat was found in the heart, lungs, liver and kidneys. The lower lobe of the right lung

was hepatized and the blood-vessels of the brain were filled with dark fluid.

As to treatment in this class of cases, the measures suitable to true shock are of most value, as heat, opium, strychnia, digitalis, alcoholic stimulants and intravenous infusion or hypodermoclysis of normal saline solution.

When fracture or crushing injury of large bones has occurred it is very important that the limb be immobilized as soon as possible, so that the freeing and absorption of fat cells may be prevented.

DISCUSSION.

DR. H. B. JENNINGS, Council Bluffs, Iowa—In speaking of the treatment of surgical shock, I think the Doctor omitted one of the most useful remedies we have. I do not believe there is a single remedy that is more useful in the treatment of shock than atropin or belladonna, and particularly atropin, because it represents all there is of the drug, and it certainly is physiologically indicated to overcome all conditions of shock more persistently than any other drug we have. Where we have the condition of shock mentioned by the Doctor, with possible paralysis of the vasomotor centers, a cold, bleached face, atropin is a drug that overcomes in a natural and physiological way all of those symptoms. It dries the skin, increases the heart's action. It is a vasomotor stimulant, not a vasomotor dilator, and I do not think there is any drug in the pharmacopeia that ranks with atropin under these conditions. It should head the list at all times, because it is physiologically an antidote, if there is one, to shock.

DR. GERMAN (closing the discussion)—In presenting this paper, it was not my purpose to embody anything new or startling regarding surgical shock, but my chief wish was to call your attention to fat embolism.

THE DIAGNOSIS AND TREATMENT OF INJURIES OF THE HEAD.

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Injuries of the head are frequent, exceedingly variable in character, notably uncertain of prognosis, and often disastrous in their immediate or remote results. There is considerable difficulty in classifying serious lesions of this region to the greatest practical advantage. The usual tendency to place special emphasis upon the presence or absence of fracture of the bones is misleading clinically, because, for the most part, fracture when recognizable is of entirely secondary importance to injury of the cranial contents, because fracture is not always recognizable or treatable, and because in any event the treatment of skull fractures has little in common with that of other bones.

It is exceedingly helpful to study head injuries from a distinctly clinical standpoint somewhat after the manner in vogue in the presence of injuries to the other great cavities, the adbomen and thorax. In the one case as in the others, the chief rôle of treatment lies in the prevention of infection and the control of hemorrhage, together with the removal of the sources of present or future cortical irritation. That diagnosis which is sufficient to point the way to the most efficient treatment is alone of paramount importance; the exact recogni-

tion of conditions about which nothing material may be done is more or less vain, particularly if it divert the attention from a single detail of practical succor. Hence, that practical diagnosis which promptly recognizes the indications for action, or appreciates the negative signs which counsel masterly inactivity, is the most utile.

It is my present purpose to call attention to some perhaps well known, but sometimes forgotten, precepts, and to elicit discussion upon some still unsettled problems in the technique of opening and closing the skull.

The first duty in all head injuries is a careful and systematic examination. For this purpose it is always desirable, and usually necessary, to clip or shave the whole head. If there has been extensive wound of the soft parts, ever so slight a penetrating wound or fracture of the skull, shaving the whole head should be insisted on as the first necessity. The most astounding blunders in diagnosis as well as barbarous transgressions of the laws of asepsis are still occasionally observed. I have known a boy to be carted about and *x*-rayed in two or three planes, at great trouble, expense and risk, when a few moments subsequent use of the razor showed the small bullet to have emerged three-fourths of an inch from the wound of entrance.

All points of contusion, ecchymosis or hematoma, should be carefully noted and examined. Two conditions need special consideration: 1. The natural irregularities of the skull. Such depressions may be mistaken for depressed fractures, or, much more frequently, in damage cases are claimed as such later on. If the head has been shaven and carefully examined at the time of accident such claims may often be much more easily refuted. 2. The embossments and tumefactions caused by extracranial effusions of blood may lead to errors of diagnosis unless carefully studied. Such effusions may be located superficially in the cellulo-fatty tissue, i. e., subsutaneously, or deeply. The subcutane-

ous boss is sharply circumscribed. If small in quantity and intimately infiltrated into the cellulo-fatty tissue it is remarkably hard, but if the quantity be large so as to dissect up the tissues, it is soft and fluctuating. But this fluctuation is superficial and readily distinguished from that of a subaponeurotic effusion. The bosses produced by subaponeurotic and subperiosteal effusions are more diffuse, their hardness more abrupt and fluctuation, if present, deep. Usually these effusions give rise to little trouble in diagnosis, but under certain conditions they may quite remarkably simulate fracture with depression. First in the early history of the case, when there is at once infiltration into the subcutaneous tissues and also a deep effusion, one finds the boss from the start hard on the periphery and soft in the center, giving the appearance of a distinctly depressed area of bone. I have known this condition in two instances to mislead the examiner into a diagnosis of depressed fracture; continued pressure on the hard rim, however, enables the finger to recognize the subjacent bone in its normal plane with that of the apparently depressed region. Second, at a later period a deep-seated embossment may undergo central softening while the periphery remains hard.

A careful study of the discharges of blood and serum from the ear or nose, the behavior of ecchymosis of the mastoid region, of the conjunctivæ, of the pharynx, etc., and the disturbance of function of cranial nerves, is important. In case of external wound or probable fracture at the base communicating with the exterior, the greatest possible antiseptic precautions should be at once instituted. It is well as a routine practice to cleanse the various cavities, exposing the brain to infection when fracture communicating with them is thought possible. The nose should be douched with boric acid solution, and nostrils lightly plugged with sterile cotton. The mouth and pharynx need to be kept

cleansed by mild antiseptic washes. While all this may sound stale, we are frequently reminded at the bedside that the average practitioner is still far from alive to the necessity of prompt and constant attention to these details in head injuries. Men who exhibit considerable respect for the abdomen, aseptically speaking, forget the needs of the cranial cavity, especially if there be no glaring cranial wound.

If there be scalp wound, compound fracture, or any indication for operation, the scalp must be cleansed in the most thorough manner possible. It should be thoroughly scrubbed with hot water and soap; then with 1 to 20 chlorinated soda, rinsed off with sterile water; rescrubbed with 1 to 1000 bichlorid and covered with a mild, moist bichlorid gauze dressing; wounds of the soft part are explored, perhaps enlarged, carefully irrigated and cleansed, and if lacerated and contused, trimmed with scissors in a surgical manner.

If there is no indication for immediate operative interference, the patient should be placed under the care of a good nurse, who may watch and record the pulse, temperature, respiration and movements of the patient. He should be placed in a warm bed with the head low. During the early stages of concussion, warmth to the feet, counter-irritation to the epigastrium and cardia are useful. If the pulse becomes bad, strychnia or atropin may be administered. In the stage of excitement which usually follows the period of depression, great restlessness, headache, etc., the bromids, or even a little morphin, is useful. However, in this class of injuries the first and greatest duty is rigid asepsis. The second is the securing of a careful consecutive history of the progress of the case from the time of the injury, and this should be reduced to writing as it transpires and not left to guess-work and memory. And third, the observation of certain general precepts, among which may be stated: The recumbent position, with absence of noise

and excitement, should be kept until the symptoms have well resolved. All cases of serious head injury should be carefully observed for at least a month. The prognosis should be guarded, and in cases liable to litigation, it should be guarded both ways. Persons looking for damages are liable to store up all the symptoms and loose talk of the doctors and make the most of it. It is as unwise to discuss all the possible calamities that might follow a blow on the head, as to assure such a patient when he wakes out of the concussion that he is all right. The better course for all concerned is to observe keenly until the case is cleared up; state only the evident facts and prophesy not.

Having made such a local examination and thrown out the necessary lines of defense, so to speak, he is in a position to with safety assume the offensive in case of necessity. While he may still often be far from clear as to the extent, seriousness and outcome of the case, so far as his activity is concerned, he finds it already falls, or in its further development will fall, into one of the following four classes, or one of their subclasses:

Injuries Without Important Local Signs or Definite Focal Symptoms.—The following instance may be taken as somewhat typical in a general way of this class, though perhaps unusually severe:

P. W. D., a switchman, aged 38, was coupling cars, Dec. 3, 1898, when the draw-pin broke and a piece of it struck him with great force on the top of his head. He fell unconscious and was removed at once to the hospital, reaching there at 10 a.m. in a semicomatose condition, his pulse 72, rectal temperature 98 degrees. On my arrival at 12:30 he was taken to the operating-room; the head completely shaved and cleansed; the ears cleansed and examined, no discharge or injury found, but insufflated with boric acid and plugged with cotton. There was a contusion 1½ inches long and about one-half that breadth at the vertex, in the medial line, the

most careful examination revealing no evidences of fracture. The abrasion was dressed with boric acid powder, the head bandaged and the patient returned to bed. He vomited twice during the day. There was retention of urine requiring the use of the catheter for fourteen days, or till December 17. From the time I saw him, at 12 m., December 3, till December 14, or eleven days, he remained in a semicomatose condition most of the time, i. e., he slept or snored most of the time when left alone, but at times was restless and flopped about and had to be strapped in the bed. When attempts were made to catheterize him he became very violent, insomuch that it took several persons to hold him, and once my assistant had to give chloroform to draw the urine. During these eleven days he spoke twice—on the second and ninth day he asked for a drink.

His temperature, a trifle subnormal at first, after the second day rose slightly above normal occasionally, but fluctuated between 97.5 and 100 F. The pulse on the third day reached the lowest point, of 42; during the next four days it varied between 42 and 60. During the second week the pulse was still more variable, some days varying from 58 to 85. On the fourth day he would sit up and take milk when told to do so, and he occasionally seemed to vaguely understand some things that were said to him, but he did not regain consciousness to know where he was or what was wrong until December 17, two weeks after the injury. December 10, at 9:30, he had a convulsion which was general and lasted but about two minutes; also a similar one December 12. Several uranalyses showed nothing of special interest, unless some increased indican reaction. From December 15 to 22, his condition gradually cleared up and he was taken home on the latter date. He was up and about the house, complaining of some headache, weakness and dizziness, gradually improving until January 14, when he came to the office, and resumed work a week later, or seven weeks after the accident.

I will not at this time discuss the condition further than to say that, at the first examination, my diagnosis might be said to have been the negative one: Severe head injury, no external wound, no focal cerebral symptoms, no indication for operation. During the further watching through two weeks with rational attention to symptoms, nothing occurred to remove the case from this category until spontaneous recovery.

If time permitted, many cases might be related as starting out in this class, but which, after a few hours or a few days, variously deviated in the most diverse courses. Of course the development of localized cerebral symptoms removes the case to another class and indicates our surgical duty, but until such indications arise the treatment must be non-operative, let the outcome be what it may. To open the head under such conditions is to go hit-or-miss, quite as likely to do harm as to do good, and is on a par with the generalship which would lead an army blindly into an unknown country and against an enemy of which nothing was known save that one of some kind existed somewhere. In the one case as in the other, chance may now and then approve the result, but the rule must be disaster, and the practice is not scientific.

There is Fracture of the Vault without Wound.—These cases may be considered under the following subdivisions:

1. There are local signs—i. e., of fracture—but no focal cerebral symptoms. The same methodical examination of the head indicates fracture. Sometimes a fissure may be detected by the finger, or a point may be felt which yields under the finger pressure, or local tenderness and the reaction of defense may convince the surgeon that fracture is present. Yet, however clear the evidence of fracture, excepting only a considerable depression over the motor areas, there is no indication for immediate operation. Wait and watch develop-

ments just as in the previous instance; if, as the concussion dissipates, giving place to a sort of hebetude with ability to move the limbs at command, the facial expression regular, speech slow but correct, in short, no localized phenomena, the treatment becomes identical with that outlined above.

If, however, the examination has disclosed a depression, there is longer but little difference of opinion as to the proper course. It may well be doubted whether a moderate depression of a considerable area of skull is of itself a serious matter. Indeed, the depression of a small area is more often accompanied with sources of irritating mischief than the slight flattening of a considerable area. But in either event it is the possibility of displacements of fragments of the internal table, injuries to brain and membranes, and probable blood-clots that render the advice to always trephine in the presence of decided depression wise. Under careful and judicious operating, with proper facilities for rigid asepsis, even suspected depression had best be cleared up by exploratory incision and actual depression always relieved by trephining. Under less perfect conditions for operating, some slighter depressions unaccompanied by external wound or localized cerebral symptoms are not of such imperative importance as to justify hasty resort to opening the skull. The condition can wait; a secondary operation under perfect conditions is preferable to the slightest risk of infection.

2. There are local signs of simple fracture with focal cerebral symptoms. These are the cases of real urgency. The necessity for operative interference is clear and unmistakable. It only remains to interpret the symptoms and decide upon the operative technique. There are four sets of cases falling under this subclass:

a. The focal symptoms are on the side opposite the cranial lesion. There is aphasia, or hemiplegia, or a monoplegia of the upper or lower extremity. To trephine

at the site of injury including the motor area indicated by the focal symptoms, is the clear and sole indication.

b. The focal symptoms are on the *same* side as the cranial lesion. Here the indications are not quite as clear in detail. Lejars advises first trephining at the site of injury, which may, he says, discover conditions dispensing with further intervention; if not, he then advises trephining in the zone indicated by the focal symptoms. In the cases of this class falling under my observation I have trephined at once on the side opposite the injury, found and removed the clot and ligated the vessel, and relieved the patient without exploring at the point of injury at all. If there were manifest cause to open at the point of injury, it may be granted that it were well to do that first, but it should be remembered that in this class of injury the mischief is apt to be chiefly on the opposite side of the skull, with perhaps none, or but slight, fissure at the point of receipt of the injury. If the force is such as to crush in the skull at the point of injury, *contre-coup* symptoms are not often observed. The experiments of Felizet show the rationale of these so-called *contre-coup* injuries, and why, though the skull is sometimes fractured on the opposite side, much more frequently lesions of the cranial contents take place there. On account of the elasticity of the skull as a whole, compression of one side by a blow causes a corresponding falling of the opposite pole. Being less elastic and more friable than bone, the brain and membranes are more liable to laceration. It would seem the most rational course in these cases to trephine at the point indicated by the focal symptoms, and open at the site of injury only in case of clear indications for so doing.

c. There is crossed paralysis, facial paralysis on the same side, and mono- or hemiplegia on the side opposite to the site of injury. The indication remains to trephine over the motor area implicated, though the prog-

nosis is bad, as the facial paralysis indicates an extension of the fissure to the base, involving the temporal bone.

d. The symptoms are associated in a complex fashion, and without connection with any determinable cranial lesion. There is probably extensive brain contusion, and the prognosis is always obscure. There is no rational basis for operative interference, and the treatment must be along the general lines indicated in the first category.

3. With, or more frequently without, local signs of fracture, there arise localized cerebral symptoms of compression indicating, most frequently, rupture of the middle meningeal.

In these injuries often the patient has not been rendered entirely unconscious or has remained so but a few moments. He may have been able to get up and walk about some. In any event, after the initial stupor has passed off, there is seen to be no paralysis. If now, after such a free interval, whether of some minutes' or some hours' duration, a slowly progressive hemiplegia develops, renewed loss of consciousness, depressed or stertorous respiration, perhaps dilatation of the pupil of the injured side, the indication is clear to at once open the skull at the proper point, evacuate the compressing clots and seek to control the hemorrhage. At the operation one of three conditions may confront us: *a.* By far most commonly an extradural hemorrhage from the middle meningeal, and generally from the anterior branch. This is the most satisfactory condition, because if promptly recognized and the artery tied or controlled, the brain is ordinarily not injured, and the prognosis good. *b.* If on opening the skull at the point of election, no extradural clot is found, but the dura is tense and bulging into the wound, perhaps showing a dark bluish color, on opening the dura a subdural clot is found, the clot should be removed with more care and

with less attempt to follow up the thin diffuse margins, which may injure the brain or excite grave cortical hemorrhage. *c.* It may be, after the dura is opened, that but a thin layer of blood covers a bulging dark cortex, indicating an intracerebral hematoma, in which case the cortex must be incised, the clots evacuated; if bleeding continues, tamponade of the cavity. The prognosis in the latter, particularly the last, variety of intracranial hemorrhage is most grave, and the treatment far less satisfactory than in the extradural variety.

There are Signs of Fracture of the Base, but no localized Cerebral Symptoms.—Ecchymoses appearing without other cause beneath the conjunctivæ and eyelids, the mucosa of the pharynx, or in the mastoid region, are often quite pathognomonic of fracture through the respective fossæ. Hemorrhage from the ear, nose or pharynx may be cautiously taken as evidence of fracture, when an extracranial source of the bleeding is fairly excluded, and the less frequent escape of cerebrospinal fluid, when demonstrated, is conclusive. The paralysis of cranial nerves is also frequently sufficiently characteristic in its course to justify alone or in connection with other symptoms, the diagnosis of fracture.

Slight fractures of the base of the skull probably often occur without any diagnostic symptoms. I find many physicians look upon fracture of the base as almost necessarily fatal, and point to eventual recovery as proof that the diagnosis of fracture was erroneous. Even Gross[1] says: "Fracture of the base, if at all severe, is seldom followed by recovery. I myself, out of at least a dozen instances of this kind, witnessed only one in which the patient was saved."

I can recall at least half a dozen instances in which the evidences of fracture were clear, and yet the patients evidently recovered. In one case in particular, a large array of surgeons and specialists agreed with me and reported to the railway company that the patient

would die, yet he finally recovered. There is no reason why fissure running into or across the base of the skull should necessarily be fatal, and under proper care and treatment many such cases do recover. Deroubaix[2] says: "The prognosis in fracture of the base is much more favorable than formerly taught; some surgeons of the present day even assert that there are more recoveries than deaths."

Next to severe concussion and brain laceration, the chief causes of death are hemorrhage and infection. Operative interference has never in my experience been of avail in these cases, i. e., in the absence of focal brain symptoms, though the condition would seem to indicate intracranial pressure probably from hemorrhage. In a man who remained unconscious at the end of ten days, I trephined low down in the temporal region and removed some clots from the middle fossa. He regained consciousness somewhat for several days, but finally died and the autopsy showed deep inaccessible brain abscess from infection through the ethmoid.

In short, for the most part, the preventable deaths from these injuries are due to infection. If the concussion and brain contusion has not been sufficient to destroy life, these patients would survive if infection, usually through the nose and ear, could be prevented. Unfortunately our best endeavors are, in the nature of the case, very imperfect, since anything like a sterilization of the nasal, pharyngeal and aural cavities is entirely impracticable. None the less, a careful initial cleansing and continued care of the ear, nose and throat in all fractures of the base is perhaps not yet sufficiently practiced.

Occasionally a brain abscess develops later and may be located by inference or by symptoms, and opened with some prospects of success. It is sometimes several months after the injury before the symptoms of abscess arise. The three instances falling under my observation

did not succeed because there were other foci, discovered only at the autopsy, which could not be located or reached. In other words, infection in fractures of the base is for the most part too acute and diffuse or too deep-seated to be relieved by operation, and even the rarer chronic and localized suppurations arising from this cause are apt to present either difficulty in localization or multiple foci so that after the surgeon has been fortunate enough to open and drain a pus cavity, he finds at the autopsy that one or more others have escaped him.

Fracture of the Vault with Wound.—This condition always calls for more or less operative interference. In all cases the whole head should be rendered as aseptic as possible, the wound cleansed and enlarged sufficiently to well explore the seat of fracture. These injuries are so various that only general principles can be enunciated, but it may be asserted that it is well to open the skull sufficiently to remove all fragments, clots and foreign bodies and to elevate depressed areas.

In this class of injuries the head has already been more or less opened for us, and it often remains only to carefully pick out the crushed pieces with forceps and elevator and smooth up rough edges and spicula with rongeur or chisel. If the breach in the cranial vault is less complete, a small trephine hole partly placed on the sound border gives us *entré* to the depressed area. In opening these already crushed crania, the elevator, chisel, small trephine and rongeur forceps are quite sufficient. There appears to be no practical way yet devised to avoid the loss of the protective bony wall in these cases, at least primarily. Whatever may be said of autoplasty or heteroplasty, it will, I think, be conceded that such operations are not often practicable in traumatic cases unless as secondary procedures. The conditions are not favorable to the perfect healing in of a foreign body, and the patient suffering from a recent skull fracture extensive enough to call for remedy of the

defect is in no condition for a prolonged autoplastic procedure. Furthermore, experimental studies and practical results leave it very open to doubt whether any of these methods fulfil their real practical object, viz., avoidance of cortical irritation, any better on the whole than simple aseptic healing without irritation.

Our technique in intracranial surgery is still extremely defective in two regards: 1, in not yet having perfected an easy, rapid and safe method of opening the skull; 2, in our inability to prevent a more or less welding of all the tissues, brain, membranes and scalp into one scar, which often proves a source of cortical irritation.

While large bony defects of the cranial vault are not without their very manifest inconveniences, it may be doubted whether the loss of bone is per se the cause of irritating symptoms. It is quite clearly the cohesion of the cortex and superficial parts that is most objectionable. Some years ago Park advised the use of gold leaf between the injured cortex and the dura. I believe he has since found it impracticable. In two very favorable non-traumatic cases I employed it. Although both ran a perfectly aseptic course, there soon—three and four weeks—appeared a fluctuating, painful swelling which had to be opened, evacuating a quantity of serum, and this continued to reopen until the gold foil was wholly removed; I therefore ceased further trial of it. Minter[3] reports similar results. Some one proposed the use of egg membrane as an absorbable material for this purpose, and I also made use of it twice in trephining for traumatic epilepsy, with precisely similar results. The wounds healed perfectly, but at the end of two weeks a painful swelling appeared, and the egg membrane had to be removed. In one case the wound was re-opened, the serum evacuated and, as I supposed, the egg membrane all removed, the wound reclosed and the patient was sent home much improved, but as is usual in such

cases, *not* entirely cured of his epilepsy. A swelling reappeared under the scalp, and the family doctor some weeks later opened it and another considerable piece of egg membrane came out, after which the wound permanently closed.

McKosh[4] reports a case which he trephined for epilepsy in which in the center of a mass of dense connective tissue he found some blackish particles, which proved on examination to be fragments of rubber—the remains of rubber tissue put in at a previous operation to prevent adhesion of the cortex. The scar tissue surrounding it, which was removed, represented a tumor the size of a walnut.

From my own brief experience and such reports as have come to my notice I am convinced that the insertion of foreign substances between the dura and cortex is wholly objectionable. That far from preventing adhesions it usually increases them by the irritation which it excites, even under the most favorable conditions.

One object of removing blood clots is to prevent cyst formation, and foreign substances would appear more objectionable than blood, and I think experience has proven them to be so. So far as adhesions of the cortex and dura are concerned we may safely rely, for the best possible results, on securing the most rapid aseptic healing, after the greatest possible conserving of the dura, and, as far as possible, stitching it carefully together with fine catgut. In closing the head, as in closing the abdomen, the best results follow the most accurate approximation of the different tissues, layer by layer. But where, as in the present case, the bone is necessarily fragmented and wholly removed from its vascular connections the defect may as well be left, at least for the present, but approximating the other structures as accurately as possible and securing healing with the least excitation of connective tissue. When the defect is small and the periosteum preserved, especially in children, bony repair takes place.

Some have laid stress on replacing trephine buttons, or even advised covering the defect with a mosaic of the fragments removed, and it is true that they sometimes appear to succeed. However, there are two objections to the practice: 1. Especially in traumatic cases these pieces often undergo necrosis and have to be removed, and when they thus delay union they excite connective tissue proliferation and, in addition to failing in their object, leave a less favorable cicatrix. 2. The histologic observations, after bone implantation, by Barth[5] and others show that pieces of bone which have been separated entirely from their anatomical surroundings, when returned to their former place, or placed in another defect in the human skeleton, indeed may grow, yet in all cases undergo necrosis.

The trephine button, about the fifth day, is found adherent to the dura by a deposit of fibrin, while the chinks and spaces about it are filled with fibrin. The nuclei of the transplanted bone cells appear as empty spaces or are seen to undergo degeneration. Now an active proliferation of connective tissue begins over the periosteum and dura mater; young granulation tissue grows into the spaces of the dead bone button, absorbs the fibrin coagulum, incloses in its meshes and vascularizes the dead bone as a porous foreign body. Almost immediately—sometimes after the seventh day—a deposit of new bone over the dura mater begins, which is deposited in lamellæ through the dead bone. It is this constant deposit of new bone through the dead button that is peculiar to the first few weeks. This goes on steadily from week to week as the dead bone becomes replaced by the living; it goes on without any anatomic appearance of the old bone being absorbed; it much resembles cartilaginous bone formations as observed in fetal long bones. According to B., this process is found in all cases where the button is not cast off as a sequestrum; it heals thus only when it fits well into the defect: the whole process

takes perhaps two months, under favorable circumstances; he replaced buttons after maceration in potash and staining with boiling carmin; they healed in the same manner as fresh implanted pieces.

Von Eislesberg, Fraenkel and others appear to hold the same views. The latter claims that all organic material becomes adherent to the dura and that only inorganic material, into which granulations from the dura can not enter, prevent adhesion. From the time of Paré attempts have occasionally been made to implant metallic plates into skull defects, and gold, silver, platinum, aluminum and many other substances have been tried. Of late years interest in the matter has revived and the practice apparently increased. The general opinion appears to be that celluloid is the best material. Among the good qualities of the material are cheapness, lightness, ease of shaping with scissors and its being a relatively poor conductor of heat. Dr. Curtiss suggests that aluminum plates might be absorbed in the course of years under the alkalinity of the blood serum. It is not, however, my intention to go deeply into this question, since I believe the use of such plates is not as yet to be advised in primary traumatic cases, and, in any case, it is still an open question whether they really accomplish their main object of preventing irritation of the cortex. Hence it has appeared to me that the best results in cases where the skull is crushed in by accident are likely to follow the greatest possible conservation of bone, periosteum and membranes consistent with efficient work, with accurate adjustment of the soft parts, especially of the dura and the periosteum, and rapid aseptic healing. In operating through an intact or simply fissured skull, however, as for rupture of the meningeal artery, the matter is quite different. Under such conditions the trend of surgical opinion is strongly toward a more ideal opening and closure of the cranium, and the use of trephines, rongeurs, etc., which sacrifice considerable areas

of bone and slowly produce, often, quite inefficient access to the cavity, are deprecated. In such cases osteoplastic resections of large bone flaps (Wagner, 1889) has many advantages, and is strongly to be advised. It is more easy and certain to find and to ligate vessels and to remove clots by this method. But, of probably far greater moment, it is the only method which fully preserves the integrity of the skull and prevents adhesion of the dura. It is certainly the ideal method of closing the skull. As yet the chief difficulty lies in the technique of executing it skilfully.

There is litle question but the chisel is the most practicable instrument for making these bone flaps. When one has become skilful in its use the skull can be opened accurately with great rapidity to almost any desired extent, and the tools are cheap, portable and easily kept in order. One has only to perfect himself into a good workman, and he has always full command of the situation. Unfortunately there is a great objection to this otherwise facile and simple instrument for opening the cranium. The concussion of the mallet is more or less dangerous, especially when intracranial pressure exists, so that a majority of the most experienced in brain surgery, including Horsley and Keen, protest against its use. Various saws have been invented for this purpose, of which Van Arsdale's appears to be theoretically very perfect. While I have not perhaps had sufficient experience with this apparatus to speak dogmatically upon its worth, I have worked with it sufficiently to discover some of its defects, and to fear that I shall never be able to learn to use it with satisfaction. In the first place, the apparatus is quite complicated and expensive, an objection of no great consequence if the practical excellence of its work were commensurate with the outlay and care. The vibrations of the necessarily rather stiff cable render the saw hard to direct with precision, but it is the tendency of the saw to get stuck in the circular

groove in the bone, being removed with great difficulty, that I have found the most discouraging. While very ingenious the saw would appear entirely unnecessarily complicated in constructing it to cut in a circle. There is no especial reason for making osteoplastic flaps circular, in fact, rectilinear flaps are I believe entirely preferable, and I believe Van Arsdale's saw, if simplified to cut a plain straight line, may prove to be the instrument for which we are looking. In any event

Diagram showing the command of the middle meningeal artery by Wagner's osteoplastic resection, also the method of locating the anterior and posterior branches of the artery in trephining according to Steiner.

there is little doubt that the difficulties of osteoplastic resection of the skull will be surmounted. In Germany, where for a time the chisel was so much used, there appears to be a tendency to combine the use of circular saws and chisel, sawing through the outer table and the diploe and finishing with the chisel. In my limited experience on the living skull and the cadaver, I have found it much easier to make the flap rectilinear; then

with a very small trephine four holes are made at the respective angles, after which the flap may be completed by the chisel, or by a wire saw passed from one hole to the other between the skull and the dura and cutting from within outward.

Of course every method yet devised has its advantages and disadvantages. The only disadvantage of Gigli's wire saw is in carrying it from one opening to another and getting it buried in the bone without wounding the dura. This danger is not greater, and as easily overcome, as the liability to similar accidents by other methods. Its advantages I think on the whole clearly distance all other instruments as yet devised: 1, exceeding simplicity and cheapness; 2, very considerable rapidity; 3, the saw-cut is exceedingly fine, doubtless the finest that can be made by any method, and as will be seen by the specimen presented, may be cut as beveled as desired so that the resected piece of bone fits back more accurately than if cut by any other method with which I am acquainted.

By the osteoplastic method of operating for intracranial hemorrhage, the matter of localization becomes very simple. A flap with its base just above the zygomatic arch and its summit rising above the inferior temporal ridge, amply commands both branches of the middle meningeal artery, and can scarcely fail to give us the desired access to all operative cases of intracranial hemorrhage. By going well down toward the zygomatic arch, it gives the best command of the middle fossa, or if symptoms indicate pressure on the lower portion of the motor area, it may be placed a little higher. However, it is well to locate and mark by some of the common methods the probable location of the vessels, as it reassures the operator in marking out his flap. The method of Steiner is very simple and as accurate as any. He draws a line from the middle of the glabella to the apex of the mastoid process and erects a per-

pendicular at the center of the line. Where the latter intersects a third line, passing horizontally through the glabella, there is the anterior branch of the middle meningeal; where a vertical line passing in front of the mastoid intersects the horizontal line, there is the posterior branch.

In emergency surgery, simplicity of methods both in diagnosis and operative technique are of great importance. The fissure of Rolando is readily located by finding its superior end at one-half inch behind half way from the nasal fossa to the occipital protuberance, from whence it runs downward and forward at an angle of 67.5 degrees for a distance of 3⅜ inches. This angle is readily measured by Chene's method of folding a square piece of paper so as to get an angle of 45 degrees, one of the leaves being again folded so as to get an angle of 22.5, which, added to the first, marks an angle of 67.5 degrees. This paper applied to the skull enables us to trace the Rolandic fissure with sufficient accuracy for operative purposes by the large openings now in vogue.

REFERENCES.

1. Gross: System of Surg., vol. ii, p. 62.
2. Archives Med. Belges, June, 1892.
3. Tiffany: Technique of Intercranial Surgery; Annals of Surg., vol. xxvi, 1897, p. 307.
4. McKosh, A. J.: Trephining for Epilepsy; Ibid., vol. xxvii, 1898, p. 670.
5. Chirurgie Opératoire du Système Nerveux, Chipault.
6. Chirurdie d'urgence, Lejars.
7. Meyer, W.: Injuries of the Head; Annals of Surg., vol. xxi, 1895, p. 310.
8. Van Arsdale, W. W.: Technique of Temporary Resection of the Skull, Etc.; Ibid., vol. xxiv, 1896, p. 465.
9. Nancrede: Operation of Trephining for Jacksonian Focal Epilepsy; Ibid., vol. xxiv, p. 122.
10. Von Eislesberg, of Utrecht: Treatment of Bony Defects of the Skull.
11. Horsley, V.: Points in the Operative Treatment of Cerebral Tumors; Med. Jour., Dec. 23, 1893.
12. Minter, H., of Buffalo: Head Injuries, Contributions to Study of; vol. xix, p. 539.
13. Barth, A.: Marburg; Histological Observations After Bone Implantation; Verh. der Deutsch. Gesellschaft f. Chir., xx Kong. (Quoted in Annals of Surg., vol. xviii, p. 460.)

14. Stenzel: Trephining for Hemorrhage After Fracture of the Base of the Skull; Annals of Surg., vol. xviii, p. 460.

15. D'Antona: A New Method of Determining Cranial Topography.

16. Osteoplastic Operation for Bony Defect of the Cranium, Verh. der Deutsch Gesellsch. f. Chir., xx Kong., 1891. (Quoted in Annals of Surg., vol. xv, p. 472.)

DISCUSSION.

DR. C. K. COLE, Helena, Montana—This paper is exceedingly interesting and instructive, and I regret that we have not had the privilege of hearing the whole of it. Perhaps some of us may not fully understand the conclusions Dr. Dunn has reached with reference to this work, because of his having read the paper in an abstract form or fragmentary way.

With reference to cleansing the nasal and other cavities, making them aseptic, or trying to do so, while the doctor's statements are in the right line, theoretically, I question whether practically it is possible to do much good in this direction other than by the use of ordinary methods of cleanliness. I question whether it is possible to use germicidal solutions in the nasal cavity, in the ear, or in the mouth in such a way as to insure a permanently aseptic condition. This matter has been discussed a good deal from time to time, and all authorities agree that efforts should be made in this direction, but it is generally believed by those who have had experience in this work that the results are negative, so far as the actual destruction of germs in these cavities is concerned.

With reference to Macewen's re-implantation of bone, I believe Professor Macewen abandoned that idea some time ago. After trephining, efforts have been made to replace bone and to use foreign bone substance, particularly where there has been much removal of the skull. Many American surgeons have done considerable work along this line, notably Dr. Senn, of Chicago, with the use of bone chips, but generally the results have not been satisfactory. If I understood Dr. Dunn rightly, he discountenances the use of plates as a matter of protection to the contents of the skull. For myself, I think the use of any kind of plate, whether of gold, silver, celluloid, or whatnot, is a myth. These plates have been tried for many years, but almost always, so far as I know, without satisfactory results. I think the same holds true with reference to the use of the softer materials, both animal and vegetable, which give rise to a form of irritation that necessitates an after-operation.

DR. W. W. GRANT, Denver, Colorado—I wish to say one or two words in reference to certain features which must precede, or in which we must anticipate, at least, the trephine, and

that is the kind of "fractures" that require trephining. There is very much uncertainty in the professional mind at present as to the best course to pursue in some of these cases. There has been a general impression that in a fracture of the skull with depression, regardless of whether or not there are symptoms of compression, we should resort to the use of the trephine, or the skull should be raised. I do not believe that it is wise surgery, in the absence of all motor symptoms, and where all the mental functions are intact, to trephine in cases of slightly depressed fracture, especially where there is no scalp wound. I have seen good results in cases of slight scalp wounds, in which the depression was not extreme, the intellect clear, and no trephining done. The results were perfect for years, and no bad results whatever followed. The surgical members of the profession are going back to non-interference in this class of cases.

We have another class of cases in which there is no evidence of the existence of a fracture, unless it is a simple compression. I recall a case that I saw in connection with two other surgeons, the patient having been injured in an accident on the Union Pacific Railroad. He was profoundly comatose for five days, yet not absolutely so. In this case there was a cut through the scalp of two or three inches over the sagittal suture. I believed that there should have been in this case an exploratory operation. The other surgeons disagreed with me. On the sixth day the man's condition began to improve, so much so that he recovered his senses, and recognized his wife on the eighth day. He went to his home, woke up in the morning, began to vomit, his coma returned, and he died during the day. What was death due to in that case? There was no evidence of fracture, unless compression. I believe there was either rupture of a blood vessel which called for trephining, or a depression of the inner table; at any rate, the result would have justified an exploratory operation.

Dr. Lacey—Was there any paralysis in the case?

Dr. Grant—No. He walked on the ninth day, and in less than two days later he was dead. He had a fracture of the olecranon, with a wound in the skull; but there was no paralysis, as I have before remarked. The point I wish to call attention to particularly is that this case would have justified an exploratory operation, and Roberts of Philadelphia is very explicit in his views of those cases, and in cases of fracture with symptoms of compression he advises trephining. In a case of fissured fracture, even with no depression whatever, with coma, he would consider trephining justifiable. In every case where symptoms of coma persist, an exploratory operation is, in my opinion, advisable. As to what form the operation should take, it will depend very much upon the judgment

of each surgeon. These cases are extremely interesting as to how far we can go in trephining with coma, or with or without localized paralysis. In my case we wanted a post-mortem examination, but could not get it. The patient probably died from hemorrhage, due to this accident, but the chances are that an exploratory operation might have saved his life.

Dr. W. L. Estes, South Bethlehem, Pennsylvania—I desire to express my gratification at the excellence of Dr. Dunn's paper, and I have no doubt, as Dr. Cole has remarked, that we have missed a great deal in not hearing the whole paper. The three or four points to which I desire to call the attention of the Academy may be included in the paper, and, if so, I ask Dr. Dunn's pardon for reiterating them.

In the first place, I heartily indorse the Doctor's recommendation to always shave the whole head, because it is not only of great importance to be able to see the whole head, that is, the bare scalp, but it is also extremely important to compare the two sides of the head with reference to each other. I have had my assistants and young men who have been observing my work make a diagnosis of depressed fractures of the cranium after the scalp has been shaved, because they have felt a sinking in on one side of the head. While it is true that crania are rarely absolutely symmetrical, yet if there be a depression of the same kind and about the same region on both sides of the head, it is rather suggestive that the injured side is not depressed. So it is of great importance in making up our minds as to the existence of these depressions not only to see the whole head, but to be able to feel it accurately on both sides at the same time, or take the two regions, always feeling the corresponding region on the other side. Naturally we can not compare the forehead with the occipital region.

Another point I wish to emphasize is one brought out very clearly by the Doctor, namely, never to open the skull without some focal symptoms; but there should be a distinct understanding that the patient must be kept under observation for some time and careful, systematic and scientific observations made, because something may develop. It may not occur in the first twenty-four hours after an accident, but it may occur later, and we are never safe unless we have observed these cases for at least a month or more. In any case of doubt it is well to err on the safe side, and that is to open the skull rather than to let it alone, because in these days of asepticism the opening of the cranial cavity adds really nothing to the danger of the case. Dr. Grant's case was one of grave doubt. The head of his patient might have been thoroughly explored and something found; probably there was a diffuse subdural hemorrhage, and the man died from a recurrence of the hemor-

rhage. The clot was absorbing and, moving back, detached another clot which was not thoroughly organized, the blood vessel opened, and he died of hemorrhage.

I have a case in mind bearing on the matter of not opening the skull without focal symptoms, where there was a wound on the right side of the head, with profound coma, and indications pointed altogether towards the opposite side. I raised the bone at the point of entry and found absolutely no clot, and not relieving the symptoms, I finally trephined on the other side, and I found on that side a large quantity of diffused blood, the whole subdural space being filled with liquid blood.

DR. ESKRIDGE—How long after the accident?

DR. ESTES—Twenty-four hours. I opened the cranium immediately after, but the symptoms not being relieved in the next twenty-four hours, I made an opening on the other side. This blood was removed, with some relief of the symptoms. The man eventually died. A post-mortem examination showed hemorrhages all through his cerebrum, which brings out the point which I want especially to make, that simple openings through the cranium will not avail. The suggestion of Durer, which has been amplified by Dr. Park, namely, that in all of these injuries with concussion, symptoms are not simply miliary hemorrhages or small effusions of blood, but actual contusions and lacerations, not only of the membranes, but also of the cerebral tissue itself, notably the ganglia at the base of the cranium. This man died from laceration at the base of the cranium. The effusions of blood were so diffuse and general over the thalmus and corpus striatum that trephining or opening of the cranial cavity would not have relieved him.

With reference to the replacement of fragments, I have had considerable experience in this regard. I have tried almost all of the things that have been recommended except the heavier plates. Soon after Macewen published his recommendation of replacing fragments I used this method, and in many instances I obtained excellent results. In one instance I recall, where there was an injury on the left side of the cranium, comprising an area of three and a half by two inches, where the bone was comminuted, after removing all detritus, blood clots, etc., and having kept the fragments in a hot normal solution, I replaced them, and there was perfect and absolute union, without the least drop of pus. The man made a very rapid recovery indeed after this tremendous injury. He was up and able to be about in sixteen days, with everything perfectly healed. Soon after he went home, and for six months thereafter was perfectly well, without a sign or symptom of any trouble. He went back to work as a brakeman, and

one day was struck on the head by a heavy coupling-pin, but on the opposite side of the head, and was treated at his home for a contusion. Evidently there was no depression. Six weeks later he came to me with epilepsy, and has been a confirmed epileptic since then. Whether the man would have had epilepsy without the second injury or not, I am not certain. Certain it is, the beginning of the epilepsy indicated that the irritation was the seat of the old and extensive injury. I believe, therefore, that it is better surgery not to replace the fragments of bone. As has been said, Macewen has abandoned this method of practice. In this case the injury was in such a place that some sort of covering would have been necessary had the fragments been replaced; there would almost inevitably have been considerable bulging at that region on account of gravity where these bony surfaces are irregular.

I recall the case of a boy who was kicked by a horse four or five years before I saw him, and he had lost an area of the cranium an inch and a half long by two inches, near the external frontal protuberance. The fragments of bone were not replaced. He came to me with a large meningocele, with epileptic fits occurring almost every hour, night and day. He had twenty fits in twenty-four hours. After cutting through the skin, which was perfectly adherent to the dura, on introducing my finger it went into the lateral ventrical on that side. There was absence of cerebral tissue at that location. There was a hole in the boy's brain, so to speak, and this hole went down into his lateral ventricle on that side. This could have been prevented by some form of heteroplasty, and in reasoning about this case, and in reading the work of others, I have concluded that some form of heteroplasty is an exceedingly valuable expedient in selected cases. I would not recommend it in every case. It is unnecessary in every case, but in certain cases, where the brain naturally gravitates, in a semi-solid condition it gravitates downward and will escape as a hernia, or form something like a meningocele; such a method would be applicable.

In 1895 I presented a paper to the Academy in which I spoke of the use of gold foil, and I want to say that I have been using it ever since with the most happy results. Gold foil is easy to replace between the cortex and the dura, and I believe the evils which follow the use of it arise from the fact that the gold foil is not as large as it should be. In one case in which I used the gold foil I found adhesions beyond its area, and after removing these adhesions and all of the fibrous tissue and putting in a larger piece of gold foil, the epilepsy disappeared.

Dr. J. T. Eskridge, Denver, Colorado—I only wish to say a

few words in the discussion of the paper at this time. I desire to premise my remarks by stating the subject before us would make an excellent one for a symposium to be discussed at the next meeting of the Academy. At a symposium on tumors of the brain participated in by six prominent men of Philadelphia, some years ago, three surgeons and three neurologists discussing this subject from the surgical and neurological standpoint, Dr. Keen, of Philadelphia, stated that no surgeon is justified in performing a major operation on the head without the aid of a neurologist, if one could be obtained. So highly did he value the assistance of an able neurologist that he gave it as a rule that the surgeon and neurologist in brain cases should work together; we know that the surgeon looks at these injuries of the head from his standpoint, while the neurologist views them from quite a different point of view. Personally, if I have a case under my observation of brain disease likely to necessitate the assistance of a surgeon, I want the surgeon not only for his skill in the operation, but for the valuable assistance that he can give me in diagnosis.

If the brain is greatly injured by a blow to the head, symptoms come on immediately; if the brain is injured the resulting inflammation that may take place does not develop so as to produce prominent symptoms until about three or four days later; abscesses of the brain do not manifest themselves in less than two to four weeks after injuries; in hemorrhages resulting from traumatism if the bleeding is profuse at the time of the injury we have profound symptoms, usually attended by unconsciousness and coma. Of course, we may have these symptoms from shock alone: if the hemorrhage is great the shock increases, coma deepens and death is likely to take place unless it can be prevented by an operation. If the hemorrhage is slight and gradually increases, the patient may show little shock, but several hours, or even days, after the accident, unconsciousness may result, and there is no period in these cases in which the patient recovers consciousness and again becomes comatose after the hemorrhage has become quite extensive. In the first cases mentioned, when consciousness begins to return, the patient, as a usual thing, steadily improves.

I saw the case that Dr. Grant has referred to *in articulo mortis*. The history that I obtained was, that he was quite stupid and comatose when admitted to the hospital the first time; he recovered in a few days, left the hospital, and was taken suddenly ill during the night, about four days after leaving the hospital. I saw him within a few hours after he had been sent to the hospital for the second time. His respiration was 50 to 60 per minute, his temperature 107, and his pulse uncountable. The diagnosis, to my mind, did not rest between hemorrhage from the membranes and injury to the

brain substance, because, as I have just stated, after a patient has been rendered unconscious from a hemorrhage from the membranes and begins to recover, he does not have a period during which he is comparatively well, following a comatose period, and then is suddenly taken down with hemorrhages from the membrane. In this case the diagnosis seemed to rest between a hemorrhage into the brain substance and abscess of the brain. It was too early for abscess to occur; the man was hemiplegic. My opinion was that he had suffered from hemorrhage from one of the striate arteries, but as the man was in the jaws of death it was impossible to make any satisfactory diagnosis. If this could have been done he was beyond all hope of relief from a surgical operation. There are two fractures, which, if attended by depression, to my mind, always necessitate, especially if the fracture occurs over the convex surface of the brain, trephining and elevation of the depressed bone; these are punctured and linear fractures. I saw a case recently in St. Luke's Hospital, Denver, in consultation with Dr. Rogers; there was a linear fracture over the anterior convex surface of the left frontal lobe, with slight depression. The doctor believed an operation was advisable, and I urged the trephining, because there is much danger of laceration to the membranes in fractures of this sort. On making a trephine opening through the skull it was found that the dura and brain were lacerated and considerable hemorrhage had occurred.

Neurologists frequently meet with the unpleasant results that follow injuries to the head, such as epilepsy, involving the whole or part of the body, or other evidences of focal lesion.

DR. M. CAVANA, Oneida, N. Y.—As a substitute for the generally dull razor in the hands of unskilled nurses, I have used a depilatory for the purpose of preparing the scalp and other hairy surfaces for operation. My method consists in first removing the hair with the ordinary barber's clippers, and then to apply a paste of depilatory powder and water to the clipped surfaces, which we allow to remain for about twenty minutes. We then remove as much of the partially dried paste as possible with a spatula or dull knife, and with clean hands and sterilized water wash the surfaces clean. The depilatory being an active antiseptic, the surfaces are then ready for immediate operation, without further preparation.

The depilatory which I have used for several years, is the brand manufactured by X. A. Razin, of Philadelphia. It retails at 25 cents per two ounce bottle, and one bottle contains sufficient powder for a single application to an entire scalp, or to four perineums and pubes. The preparation removes every particle of hair, and leaves the surfaces in a cleaner and smoother state than can possibly be secured by the shaving

profess, and has no injurious effect upon the skin or hair follicles.

Dr. J. P. Lord, Omaha, Nebraska—I have no disposition to prolong the discussion on this very instructive paper, but I want to make an observation or two. We are always striving for the ideal, but in doing so we should never lose sight of the practical. It has been suggested, and the thought has occurred to me also, to raise an osteoplastic flap in cases of recent fracture of the skull. Regarding this point, I have come to the conclusion that the usual flap which is made of the scalp, including the periosteum over the area of fracture, as ordinarily made, is good surgery. To undertake to raise the whole, including the fractured bone, this flap under these conditions is unsurgical. We can not raise it perfectly, and in an attempt to break it out we would only break into the irregular depressed portion. There would be difficulty in readjusting the fragments in the proper way against the skull, and we would still have the danger of loose fragments being left because of the separation of these by the original injury or by the accumulation of blood clots, and we would still have a complicated condition. It would not be as satisfactory as the old-fashioned method of simply raising the tissues of the scalp, including the periosteum, removing the fragments in the old manner: we have less of brain defect and a less objectionable result than we are likely to have by a more extensive and, what we seek to make, ideal procedure. We encounter difficulties that we should not undertake to overcome. The surgeon in attempting to raise flaps of that kind should be provided with all of the modern accessories for raising them in the most practical way to suit the individual case. Personally, I think the De Vilbiss instrument is one of the most useful instruments we have for this extensive work on injuries of the head. The objections raised against the saws are good. If they are used, it is very essential that there should be a stream of water used to prevent undue heating of the bone, which favors necrosis.

I want to raise an objection against the use of the Gigli wire-saw in this work. Let us suppose that here is the surface of the cranium (illustrating): while it might be well to use this saw, where the bone surface is partially straight, but if we undertake to raise a considerable flap on the side of the head where there is a considerable convexity of the bone, I can not understand why the dura would not be cut into by the direction of this instrument before we could raise the point of the cut to a point sufficiently high to free it. In some skulls, especially with this concave condition of the inner surface, the use of this instrument would be precluded.

I have maintained for some years that the introduction of any kind of foreign body to secure a more ideal result is im-

practicable; that the difficulties attending its use, the prolongation of the operation, etc., more than counterbalance the occasional good results which may be secured by its use, and "It is better to bear those ills we have than to fly to others we know not of." The use of these foreign bodies may prove to be somewhat of a surgical feat in a few instances. There is a tendency on the part of surgeons to adopt some method that is brilliant, and to lose sight of the simpler methods with their compensating advantages, and, as a rule, the more simple are our procedures the better the results.

Dr. Dunn (closing the discussion)—I thank the gentlemen for their free discussion and consideration of my paper. There is one point concerning which I think Dr. Cole misunderstood me, and that is with reference to the necessity of cleansing the mouth, nose, ears, etc., in fractures at the base of the skull. I fully agree with him that we can do very little in this regard, but that little we should do with more regularity and care than is always done. We certainly should not fail to do what we can do, which is not a great deal.

CHIP OF IRON IN EYE.

EXAMINATION WITH FLUOROSCOPE NEGATIVE, WITH SIDEROSCOPE POSITIVE; EYE ENUCLEATED. SYMPATHETIC OPHTHALMITIS SIXTEEN DAYS LATER. RECOVERY. EXHIBITION OF SIDEROSCOPE.

WM. C. BANE, M.D.

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DENVER, COLO.

J. F. S., aged 24, a boiler-maker's helper in the shops of the Rock Island Railway, at Goodland, Kan., was referred to me by Dr. F. H. Smith, the company's surgeon, on Dec. 23, 1899. Two days previously he had sustained a serious accident to his left eye. He and a fellow workman were cutting off the head of a bolt three-fourths of an inch in diameter. The patient suddenly felt something strike his left eye, but the organ did not pain him much at the time nor during the succeeding forty-eight hours. The first afternoon he experienced a feeling of nausea.

On examining the eye, the pericorneal vessels were found moderately congested. In the lower quadrant of the cornea was a linear wound extending from the sclerocorneal junction upward and inward toward the center of the cornea for 4 mm. A hernia of the iris protruded through the corneal wound.

The pupil was elongated toward the wound. The iris responded promptly to light. A faint red reflex was obtained from the upper inner section of the fundus. Some opacity of the lens was seen in its lower outer quadrant. Back of the lens a dark opaque mass existed, apparently blood. Tension was — 1. Vision after the pupil was dilated equaled fingers at one foot in the temporal field only.

The hernia was excised, and the temporal portion of the iris then detached from the corneal wound, but the nasal margin remained adherent. Through the corneal wound the tip of an electro-magnet was inserted, but no evidence of metal existing near the wound was manifest. Nothing that appeared like metal was seen by focal or reflected illumination. During the following week the patient experienced several brief attacks of pain in the eye, and some tenderness to pressure over the ciliary body in the upper outer quadrant.

On December 28, Dr. Rivers saw the patient in consultation with me, and inasmuch as the eye was comparatively quiet, advised keeping it under observation until the hemorrhage had cleared up.

On Dec. 30, Dr. George Stover, in the presence of Dr. Stevens and myself made a very careful examination with his fluoroscope, but was unable to see any foreign body in the eye. After the first ten days the eye was painless and the pericorneal congestion had very perceptibly diminished. The patient was permitted to make short visits to his home in Kansas.

On Feb. 6, 1900, he returned, having been free from pain or discomfort in the eye for a month. His vision had grown dimmer, so that he could but distinguish a hand as a moving object in the temporal field.

Desiring to learn, if possible, whether or not the eye contained a piece of metal, I constructed an instrument, on the principle of the sideroscope of Dr. Asmus of Dusseldorf. I am indebted to Dr. Jackson for the loan of a German edition of Dr. Asmus' work, descriptive and illustrative of the sideroscope, which was issued in 1898.

The instrument is simply a magnetized rod of steel, 2 mm. in thickness and 11 cm. in length, suspended by some fibers of raw silk. The silk and rod are protected from the air by glass tubes. On the center of the bar is attached a small mirror 10 or 12 mm. in diameter. The instrument is so placed that when the magnet is at rest the ends are respectively north and south. The room being darkened, a light is thrown on to the mirror, from which a beam of light is reflected on to a scale, the latter being so placed that the beam of light will strike it at the zero point.

Having the instrument ready for the test on the patient's

return, February 6, the eye was cocainized and gradually brought in contact with the glass tube, in which was suspended the magnetized bar. The bar was at once attracted toward the eye, giving positive evidence that the organ contained a piece of iron or steel. The test was repeated the same day in the presence of Drs. Ed. Jackson and W. W. Grant. On the following morning I repeated the test before the class at Denver College of Medicine, after which, with the assistance of Dr. Grant, I searched for the piece of metal with an electromagnet, entering the eyeball at the lower margin of the external rectus muscle near the equator. I did not pass the point of the instrument much back of the equator and failed to get the metal. I then enucleated. While I was dressing the stump, Dr. Grant opened the eyeball and found a chip of iron in the fundus of the eye near the optic nerve entrance enclosed in a mass of inflammatory deposit. The piece was 9 mm. long by 3 mm. wide at one end, and tapered to a point at the other end, being 1 mm. through its thickest part. One edge was quite sharp; weight, 1 grain.

The wound was irrigated with 1 to 500 solution of formalin and the edges quilted together with Boeckmann's silver catgut.

On the fourth day after the enucleation, I noticed, on the right eye, a point of congestion near the nasal margin of the cornea. However, as the iris was normal in appearance and action, and vision = 20/20 plus, I permitted the patient to go home, advising him to return at once, should the congestion increase.

Eight days after the patient returned home he wrote me that he was getting along nicely and asked permission to remain at home for another week. On the morning of February 25, eighteen days after the enucleation, the patient returned. He stated that his eye had not changed until two days previously, when there appeared to be some congestion of the ball. The next morning he noticed that his vision was dim. Examination revealed considerable pericorneal congestion. The pupil responded fairly well to light. Extending from the posterior margin of the pupil on to the anterior capsule were numerous points of inflammatory exudate. No punctate dots had appeared on the anterior capsule nor on Descemet's membrane. The vitreous was slightly hazy and the optic disc decidedly hyperemic. No tenderness of the eyeball existed, though that morning the patient noticed slight tenderness in the ball when washing his face. From the stump in the left orbit there was considerable mucopurulent discharge, which the patient said had increased very much during the previous forty-eight hours. Vision equaled 20/20 minus.

I at once ordered 30-grain doses of salicylate of soda to be

taken every four hours. Within a few hours the patient was seen by Drs. Rivers and Jackson. That afternoon, with the assistance of Dr. Jackson, I dissected out the cicatricial tissue of the stump, aiming to include a section of the optic nerve.

Inunctions of 1.5 drams of blue ointment were made twice daily, and an 8-grain solution of atropin instilled at intervals of three hours. By the following morning the posterior synechiæ were broken up and the pupil thoroughly dilated. The patient was confined to bed for three days, in a darkened room. After the fifth day the inunctions were omitted, but the salicylate and atropin continued. On the ninth day of treatment for the ophthalmitis, the patient came to the office. The eyeball was then quite free from pericorneal congestion. The pupil was fully dilated. On Descemet's membrane there were numerous punctuate spots of inflammatory deposit. Adhering to the anterior capsule was a ring of pigment deposits marking the points where the iris had been attached. In the center of the anterior capsule was a circular spot, 1.5 mm. in diameter, composed of fine dark dots. The vitreous had cleared somewhat, and but little hyperemia of the disc remained. Vision equaled 20/40 minus. On the twelfth day the salicylate disagreed with the stomach and was omitted for two days.

After sixteen days of treatment, the eye was free from any congestion, the vitreous clear and the inflammatory deposits on the anterior capsule and posterior layer of the cornea disappearing. Vision equaled 20/20 with + .50 S.

Sympathetic ophthalmitis is one of the most perplexing, and, at the same time, one of the most serious affections of the eye that we have to deal with. Most of the cases go on to blindness. Those that develop after enucleation of the fellow eye are more hopeful than where the process develops previously. Relapses are very liable to occur, so that a guarded prognosis is advised in cases where the disease has apparently yielded to treatment. In the case I have reported, the patient has seemingly recovered, and we can hope that no relapse will occur. He was re-examined on May 7 and July 7, and was found to have vision of 20/15. In handling this case several factors entered into the treatment of the ophthalmitis. The mercurial treatment is an old one. The dissecting out of the cicatrix and removal of a section of the optic nerve has been credited with aiding in saving the sympathetic eye.

The use of salicylate of soda in sympathetic ophthalmitis has been brought prominently before us by Dr. H. Gifford,[1] of Omaha, in a paper which he read before the Section on Ophthalmology at the AMERICAN MEDICAL ASSOCIATION meeting in Columbus, Ohio, in June, 1899.

A great deal has been claimed for the sideroscope, in not only detecting the presence of iron or steel in an eye, but also locating it.

The instrument I use is much the same as the Asmus instrument, and certainly responds promptly when a bit of iron or steel is brought within close range. To use it properly and for delicate testing, it is necessary to have it on a solid foundation that it may get perfectly quiet, and at the same time be removed several feet from iron or steel and electrical currents.

Steele Block.

1. Journal A. M. A., Feb. 11, 1900.

RAILWAY INJURIES RESULTING FROM PERSONAL NEGLIGENCE.

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With the public demand for improvement in the matter of traveling facilities, and its resulting expansion of the various railway systems of the country, came the proportionate liabilities to personal injury from accident; with the increase of the number of accidents came the additional attempts to recover from railway companies for the injuries resulting from such accidents. During that period of time dating from the completion of the early railway enterprises to the last decade, corporations were the prey and poaching fields of the unscrupulous populace and dishonest attorneys to such an extent that managers groaned under the oppressions resulting from the painful experience of the past and the discouraging outlook for the future. The many and unjust verdicts against railway companies resulting from damage suits proved the incubating element which gave birth to the now popular surgicolegal alliance, which relationship to the railway manager opened to our profession that wide field of research and experimentation which to-day comprises practically the greatest specialty of surgery.

The rapid and astonishing development of the science of railway surgery, the wonderful achievements in the saving of life and limb and the consequent lessening of

the rate of mortality, the high standard of perfection attained by the American operator, are mainly due to this and other kindred organizations, and also largely to the kings of the profession, many of whom comprise the membership of this eminent body.

With this fact in mind, I will not assume to contribute anything new by way of theory, practice or procedure in either the care of the railway injured or the technique of the operative work, as none will deny that the present literature on the subject of railway surgery is well up with the day, and fully abreast with the demands of our corporations. Having, then, successfully forced the gates and possessed ourselves of the imperial fields of the science of caring for the railway injured to that extent of expertness bordering upon perfection, may be not, with commendable reasoning, cast about for other worlds to conquer?

What, then, would impress the progressive mind more naturally as the coming duty of our departments and our corporations than that of considering, as the next progressive step the prevention of accidents? In a review of my own statistics I note that fully 95 per cent. of the cases of injury from railroad accidents is directly due to personal or contributory negligence on the part of the injured.

As the charmed bird is said to fly directly into the jaws of its reptile enemy, so we find the American boy never happier than when climbing the most dangerous precipices or trifling with the most treacherous lofts, also the adult very generally possesses that same, and as yet unexplained, tendency to trifle in the most careless manner with dangerous situations, especially those connected with moving railroad trains. What spectacle is more common to the passenger engineer than that of an apparently intelligent driver lashing his horse to a break-neck speed in the endeavor to gain a crossing in advance of a train? Also, that of a woman leisurely

approaching a railway crossing and, on discovering the approach of a train, starting at a run across the track in advance of the engine and, when safely across, deliberately coming to a halt and turning about and watching the train until it is well out of sight? How frequently these foolish undertakings result in the injury or death of the victim, and how often he or his heirs recover large verdicts from the railway corporations in such cases, and very generally upon the grounds that either the engine bell was not rung or the whistle blown, or other proper warning given to the unsuspecting victim.

Incredible as these illustrations may seem, they are nevertheless examples of the conduct of a great majority of our intelligent people while in dangerous surroundings, and especially in the vicinity of a train of cars. In this connection permit me to a brief review of the reports of a half dozen cases of railway injuries, as appearing in my own record book, which bear proof of the existing urgent demand for the consideration and adoption of some effectual remedy against personal carelessness and its serious consequences.

Mr. A., aged 68, a successful and wealthy business man of strictly temperate habits was on his way to town, riding in his carriage drawn by his favorite horse. Between his residence and the town was a single railway and crossing. Fully three-fourths of a mile of the tracks and roadbed were in plain view from all points of the highway, over a distance of a quarter of a mile from the crossing. Mr. A. had traversed this road on an average of twice a day for the previous thirty years. Approximately, he had crossed the railroad at this point about 22,000 times during his life without event. On the fatal day, while a passenger train was approaching at full speed, over the three-fourths of a mile of open country, the rider drove at a slow trot along the mentioned clear portion of the highway, in full view of the approaching train, and continued his course until the

wheels of his vehicle came in contact with the passing coaches, the horse having turned from his course in the direction of the engine, which contact resulted in the demolishing of the wagon and the instant death of the man. The heirs of the estate brought suit for $25,000 against the railway company, but the jury very justly found for the defendant.

In another case, a priest of a large and influential congregation was on his way to visit certain of his parishioners. On discovering the near approach of a fast train, he ran directly in front of the engine in the foolish attempt to cross in advance of it, with the usual fatal results.

In another instance, a young man of education and means, who was evidently possessed of the too prevailing impression that "it is no sin to beat a railway company," attempted to gain a ride of nine miles without paying therefor. In order to avoid the conductor, he swung himself from the platform, around the side of the coach, and clung to the hand rail, supporting his weight by resting one foot on a point of the lower step, thus concealing himself while the conductor crossed the platforms to the next car. In his attempt to regain the platform he discovered that the atmospheric resistance resulting from the great speed of the train prevented, and the exhaustion resulting from the vain endeavor to save himself finally forced him to release his hold and drop to the earth, after riding a distance of about four miles in this perilous position. The injury which he sustained, a fracture at the base of the skull, soon rendered him unconscious, and he lay upon the ground until discovered bv the section hands the following morning. He was conveyed to a hospital and every professional attention rendered him, but he succumbed in a few hours. The result of this foolhardy undertaking was the saving of eighteen cents in cash and the loss of his life.

A fourth case was that of a school teacher whose post of duty was some distance from her home. During severe weather she was in the habit of driving her horse to and from her school. On one very stormy morning, she heard the whistle of an engine while she was on the proximal side of a long diagonal railway crossing. She afterward confessed to the company's surgeon that her conclusion was to stop and await the passing of the train, but her second thought prompted her to whip her horse into a run and attempt to "cross ahead of the train." In this instance, the train proved to be an engine and snow-plow. Her horse passed the crossing in safety, but the huge wing of the plow caught her vehicle in such a manner and with such force as to hurl it, with its fair occupant, some fifty feet distant, over the fence of an adjoining field, landing it upon a large, soft snow-drift, thus saving her, aside from a good fright, any serious personal injury.

In another instance, an intelligent man was walking the track when overtaken by a train. Hearing its approach, he turned and stepped to one side to allow the train to pass. For some reason, which he failed to account for and could not explain, he took a position so close to the road-bed as to suffer a severe brushing by contact with the passing coaches. He was subsequently found lying in a ditch and examination of his injuries showed six fractures, two of which were compound, besides contusions and bruises too numerous to mention.

As a traveling public, how prone are we to invite casualties by our every-day conduct! An observing tourist can not fail to note, at almost every station, the inclination of a large percentage of the people to delay the boarding of their trains until the very last instant, many deferring their hand-shakings and adieus until the train arrives, then, in their late and hurried attempts to climb aboard, some drop their parcels, others miss

their footing, and, if fortunate enough to escape personal injury, they further delay the departure of the train.

The writer recently witnessed the embarking of a wedding party upon a through express. Accompanying the pair were some twelve couples who had come down to the station to see them off. The train was scheduled for fast running on that division; in order to make her time, the greatest economy at stations was necessary. The train arrived one-quarter of an hour late, and had scarcely halted when the conductor alighted and called "all aboard." At that instant the hand-shaking and kissing of the bride and groom began. The conductor repeated his cry of "all aboard" with emphasis, but the farewells cooly continued until the gauntlet had been run by the entire assemblage of twenty-six persons. In this instance, the conductor held the train until the last adieu had been given and the couple were safely on the car platform.

This conduct on the part of the public is the source of many accidents. It tends to tempt conductors to teach offenders a deserved lesson, that of starting their trains after a reasonable stop, and leaving to the hand-shakers the alternative of clambering aboard at the risk of slipping a foot under a wheel or awaiting a later train.

In the above illustrations, we have referred only to the outside public, yet we are forced to admit the regrettable fact that our mentioned criticisms of contributory negligence are also chargeable to the most experienced employees of the railroad yards and crews of trains, who, as well, frequently suffer injury as the result of their own carelessness.

Other cases and situations where railway accidents were directly due to personal negligence might be cited *ad infinitum,* if time permitted. But feeling that in this brief review of our own records, we but relate the

observations of every railway surgeon of the continent, we drop this element of our subject, and turn our attention to the one great question, the remedy.

When we pause to scan the broad field before us and to seriously estimate the extent of the territory to be covered in the application of the subject in question, we are astonished at its immensity and feel forced to the conclusion that the only effectual remedy for the prevention of personal injury from railroad accidents, as well as its application to the varied situations, is expressed in the single word, legislation.

In many of our populous districts, railway corporations have already, through legislative authority, adopted means for the prevention of injury resulting from personal negligence. By virtue of the authority gained through legislation, the elevated railroads of our larger cities are enabled to close the gates of their cars to all tardy passengers, and thus prevent all accidents heretofore resulting from the boarding of moving trains. Legislation has resulted in the placing of gates at busy street-crossings, and thus saved thousands of accidents annually in most of our larger towns. In England and certain other European provinces the laws prohibit all persons from walking upon any portion of the railroad tracks and thus prevent another very large class of accidents. May not, then, such additional legislation be enacted in the various states and countries in America, as will reduce to a minimum the number of accidents from personal negligence? Certainly such an end seems possible if undertaken in a properly-supported manner.

In am well aware that my conclusions will appear to some as a wide deviation from the real objects and provinces of this association, but all will admit that the reputable railway surgeon is an important factor in the world outside of his professional sphere. He is a prominent personage in the church, the lodge, the neigh-

borhood in which he resides, the society of his town, and in the politics of his assembly and senatorial districts, and he consequently occupies just the necessary position to influence the election of the right people to office, and to aid in the moulding of public and political sentiment to that extent of realization of this important question, as will ultimately result in the gaining of the desired victory.

THE RAILWAY SURGEON A VALUABLE AID IN THE SETTLEMENT OF CLAIMS FOR DAMAGES.

J. T .DURHAM, Esq.
ONEIDA, N. Y.

You have been engaged in the discussion of those questions which will bring you the greatest enlightenment upon the manner of treating and handling those cases of serious injury to life and limb which necessarily attend the operation of railways and great machinery. Having exchanged views with those who, by years of experience, have learned to exercise the greatest skill in the practice of their chosen profession, it may be well to turn aside for a brief period of time for the purpose of considering if there are not other obligations which you may voluntarily assume, which may prove of great value to your employer, rendering to it the proper degree of justice, and which shall aid your co-assistants in the legal profession to ascertain the truth of the conditions which have been found by you to exist; whether the injured may be in any way responsible for the existence of such injuries, or whether the corporation by which you are employed shall be called upon to render to the injured valuable compensation for the sustained injury. It is your first duty, legally and morally, to render the greatest degree of relief to those who have unfortunately sustained personal damage which may prove to be serious or possibly fatal.

Having performed this obligation, you may properly enter into the consideration of the causes leading up to the resultant injuries by means of the conditions which you find to exist. In doing this, you will not only gain valuable data for surgical purposes, but you will put yourself in a position to help in rendering justice to whom justice is due.

It is first important that you adopt as your method of procedure as surgeons, those uniform rules of practice which have been proved by past experience to conform to the highest standard of practical surgery. Not that one should select the rules which have been laid down by some writer, nor that any person should adopt an inflexible rule, regardless of what he or his associates have found to be a better method; but the railway surgeon is in duty bound to bring to bear the greatest degree of care and the highest skill for the benefit of the unfortunate. In doing this, he will conform to the practice which has been adopted by the great railway corporations in the necessary management and control of the immense railway corporations of this country. It is said that the management of 90 per cent. of the railway mileage in the United States has adopted, and is now using, the standard book of rules as formulated by the general managers of the various great railway corporations, based upon the most skilful operation and careful management of railways from the earliest dates of railway operation. It may be that a single rule or class of rules may not always, in every particular, be appropriate to the special case or circumstance; but those rules should be adopted which have been found to produce the best results in general practice, as it is for the general good that there should be uniformity of method. So it is with the practice of surgery. Your practice should be so governed; so based upon the most skilful knowledge which science has brought to general use, that all may properly approve the same. In doing

this, your acts will be vindicated by the courts, your methods will be above question, approved by your profession, and accepted as the highest degree of skill which may be brought to your aid.

In determining the question whether the injured one should bear the burden of his injuries, or whether some valuable compensation should be made to him by the railway company, it will be necessary to familiarize yourself with the general rules of negligence and ascertain all the facts leading up to and causing the accident. It usually happens that the surgeon is the first skilled person who is called to the scene of the accident, and he may be the only one having the opportunity to be present and learn from eye witnesses and appearances of wrecks, whether of cars or conveyances, whether any act of the injured has, in any way, contributed to the damage sustained.

It is an inflexible rule of law that a person who has sustained any injury or damage through the negligent act or omission of another can not recover damages if his own act or omission in any degree contributed to the injury. In other words, the plaintiff must show that he was altogether diligent before he can complain of the defendant's negligence.

It is of the greatest importance, therefore, that all of the facts leading up to and surrounding the accident should be brought to light. Marks upon vehicles, damages to rolling stock, the appearance of the surrounding earth or any other matter, however slight, should be carefully examined and noted. Such data furnished to the attorney may convey to him a valuable fund of information and largely govern him in the settlement or rejection of claims for damages which may be presented.

In a great majority of cases, persons sustaining injury are extremely grateful to the surgeon and welcome him who renders to them medical and surgical assistance.

While he is in that condition of mind it is not difficult to obtain from him a full, fair, and truthful statement of all the circumstances surrounding the case. But wounds soon heal; memory is treacherous, and the patient who, through the skill of the surgeon, is able to leave the surroundings where he received such substantial benefits, usually falls into the hands of unscrupulous persons, who, actuated by the hope of a valuable reward, do not hesitate to poison the mind and appeal to the avarice so that actions are brought which are easily commenced and still require the utmost efforts for their defense. Experience has taught that it is never safe to rely upon facts which at first glance would indicate the greatest degree of negligence on the part of the plaintiff and the least on the part of the defendant. Instances of personal observation have taught that grave injustice to railway companies can, in many cases, only be prevented by forestalling all such future lapses of memory and stretches of imagination on the part of those interested as frequently characterize the trial of negligence cases.

As an illustration of this, A., who at about 2 a.m., in a drunken stupor, had been asleep upon the highway at its crossing with the railway, was suddenly awakened and, in his dazed condition, walking to the side of the track in too close proximity to a passing train, was struck and sustained injuries of a serious nature. No employee of the railway except the engineer saw the accident. It was positively known by the employees that no person was present when the injured man was taken up and removed, in an unconscious condition, to a place for medical treatment, and yet there was nothing to hinder the injured man and his unscrupulous attorney from producing witnesses that no alarm was sounded by the train; that there was no headlight; that a high wind prevailed, carrying the sound of the oncoming train in the opposite direction; that buildings were

immediately adjacent to the railway crossing, thus producing an array of circumstances sufficient to convince any intelligent jury that the injured was innocent of contributory negligence and that the railway company was guilty of the grossest negligence. But a careful examination of all the surrounding circumstances, the voluntary statement of the injured in conversation with him from time to time, including the admission of intoxication, followed by his affidavit embodying all the circumstances, voluntarily made by him, forever precluding a successful action, was, in a large measure, due to the assistance rendered by the attending physician inthe case. Without his aid many of the opportunities for interviewing the injured might never have occurred. The slightest attempt to have gleaned from him any knowledge would, by exciting his suspicions, probably been met by a flat refusal upon his part. But, as the matter terminated, he went forth from his place of treatment fully satisfied that none but himself was to blame, and that he must forever bear the loss which he had sustained by reason of his own wilfulness.

Another illustration of the idea suggested is borne out by the circumstances in the following case: B. was driving along a highway, approaching a railroad crossing. With him were two companions, C. and D., all of whom were somewhat under the influence of intoxicants, and all sitting upon a single seat of a two-wheeled rig. B., who was the least intoxicated of the three, saw a fast train approaching and endeavored to stop the horse. Both of his companions urged the horse on and urged B. to drive across the railroad against his wishes, and by loud talking to the horse and remarks to B., they succeeded in approaching the railway, arriving simultaneously with the fast train, with the result that C. and D. were instantly killed, though B. escaped. No person aside from those in the vehicle heard the conversation. No one was within hearing distance of what

was said and it was not positively known that such conversation had taken place. B. sustained sufficient injuries to require medical attendance for a few days, and in the course of conversations with the attending physician, others being present, he stated what had taken place between the three, and the reasons why he attempted to cross the railway in front of the approaching train. His statements were placed in the form of an affidavit and willingly verified by him. This was while he was being benefited, while he was having the attendance of a most skilled surgeon, and before his gratitude had ceased.

Several months afterward, he commenced an action for his injuries and actions were commenced by the legal representatives of C. and D., to recover from the railway company. It became important to show the acts of each of the deceased immediately prior to the accident. B. was the only one who knew, and he would have readily and willingly denied the entire transaction had it not been for the affidavit which he had made soon after his injuries. In this case, doubtless, large verdicts were saved by reason of taking the matter in hand early, and by reason of the assistance rendered by the attending surgeon.

Numerous other cases might be cited showing the importance of obtaining conversations, appearances and circumstances occurring prior to the accident. and many are the verdicts which would result differently were those first upon the scene to carefully inquire, observe and note all that may be gleaned at the time, and it is for the careful attorney to separate the wheat from the chaff; to determine for himself how much of the information gained may be of value and the circumstances it will be necessary to produce; and it is upon such information oftentimes that his judgment will be governed as to the truth and justice of the claims presented for his consideration.

It is not for you to inquire whether this circumstance or that may be of material value, but to carefully record all the conversations which may tend to establish an admission for or against him who makes the statement; whether his acts before or after the occurrence are such that on a careful examination the attorney may draw a conclusion whether he is guilty or not, or whether the railway company is responsible for the damages which have been incurred.

In doing this, the question may naturally arise whether you are violating professional ethics; whether you are exceeding the privileges which are given to you as one who has been licensed to practice physic and surgery, and while the rule varies in many states of the Union, there is a general rule similar to that which was adopted by the codifiers of the laws of the State of New York, wherein the privilege of a physician when called as a witness is provided by section 834 of the Code of Civil Procedure, as follows: "A person, duly authorized to practice physic and surgery, shall not be allowed to disclose any information which he has acquired in attending a patient, in a professional capacity, and which was necessary to enable him to act in that capacity." However, the law of the same state has provided that in case of negligence, where personal injury has been sustained, the defendant, on application to the court, may have the privilege of a physical examination of a person sustaining damages and who is the plaintiff in an action to recover for injuries, and it is therefore a question whether the railway company has not taken the right which is guaranteed to it by law, that they may be privileged at the hands of their employed surgeons to render all of the assistance possible to alleviate the sufferings of the injured, and at the same time to protect itself from an unjust action by way of learning all that may be of value in determining the liability, whether it shall be by the assistance rendered by its

surgeons in connection with its attorneys, or by its attorneys alone.

Should you deem the suggestions offered of sufficient value to receive your approbation; should the practice of the ideas herein recommended render you of greater value to your employer, will you not then have more truly proved the words of the motto of the American Academy of Railway Surgeons: "The higher the order of railway surgery, the greater the protection to the employee, the passenger and the company"?

DISCUSSION.

DR. M. CAVANA, Oneida, New York—In discussing the relations of the attorney to the railway surgeon, the rule formulated by the Judge, to avoid divulging anything that may be termed professional confidence, is one that we must hold uppermost in our minds. In order to illustrate my standpoint, I recall the case of a woman who suffered from adominal disease for some years; she had worn a pessary for a uterine displacement. She was on a passenger train which jumped the track, and slid down an embankment 15 feet. I examined her carefully and reported her case as one of confirmed neurasthenia with a chronic abdominal condition, and advised the company that, if the case came to trial, undoubtedly all of the nervous conditions would be magnified and an exaggerated picture of the injuries would be presented by the patient's attorney, which would be brought to bear on the case, and as a consequence I advised a settlement as promptly as possible. During a conversation with the patient I learned her previous history, and incidentally mentioned it to the claim agent, who insisted that the company's attorney accompany me during one of my visits. He did so, and then and there propounded certain questions which were answered and made a part of the record of the case, and which would protect the company from any imposition, or from any future suits for damage. The patient's time was computed; expense of board, medical attendance, loss of time of members of the family and husband in visiting her, damage to her clothes, a reasonable damage for suffering pain was figured, and computed, all of which seemed satisfactory to her. The claim agent then doubled the amount and effected a settlement without complaint. In this case there was the combined action of the attorney with the surgeon, which resulted in a satisfactory adjustment of this claim, both to the patient and to the railway company. Had the case been delayed until her attorney had obtained a knowledge of the con-

ditions, without doubt a suit would have been brought against the railway company for enormous damages, and very likely a verdict against the company would have been rendered for much larger damages than were paid, and, of course, unjustly.

We have learned in our part of the country to co-operate with attorneys in matters that we believe to be justifiable and for the protection of the company, as well as for the satisfactory care of our patients. In this case the patient elected to employ a surgeon of the company to render the necessary care during her convalescence, so that we were occupying a double position. However, as I have previously said, the case was settled satisfactorily to all concerned. If possible, the attorney and surgeon should work in conjunction with each other.

Dr. C. K. Cole, Helena, Montana—We all come in contact with shyster lawyers from time to time who get hold of our railway patients and endeavor to get large damages against the railroad companies. It has been said that we, as medical men, are prejudiced too much in favor of the companies we represent. I believe we should aim to be strictly impartial. We should be as reasonable and consistent as possible from an ethical point of view, never lending ourselves to the assistance of a railway company or to the legal representatives in a manner which will reflect discredit upon us as physicians. The Judge, in his paper, has given us a very reasonable and rational view of this subject. He has also given us advice which is consistent, and which we may properly follow. In coming in contact with patients soon after injury, I believe it is perfectly proper for the surgeon to elicit such information as he may, without detriment to the patient, for the benefit of the claim agent or the legal representative of the railroad company.

Personally, I wish to thank the Judge for his excellent paper, and which embodies ideas which we may with perfect consistency carry out in our work.

Dr. Haldor Sneve, St. Paul—The gentleman has given us an able, instructive and interesting paper, but it involves some questions that are not clear in my own mind. I think we all agree that when we are called upon as company physicians to see patients, we do not act simply as medical men in our attitude towards these patients, but act as a sort of detective for the claim agent and the legal department of the railroad. This course is justifiable, inasmuch as we wish to get at the truth. It is advisable to see the patient at as early a time as practicable, before he or she has had time to think it over, and acquire new symptoms, which may be suggested by the patient's friends or attorney. Our accident reports are always filled out with some unwillingness. Our company requires a statement from every injured person, and the average employe always feels that he is being imposed upon by the physician who

attends his injuries, by propounding so many questions and inquiring all about the circumstances of the injury and the cause of it, so that it detracts somewhat from that cordial relation which should exist between the physician and his patient. I am not sure in my own mind but what it would be a good idea for the railroads to employ a number of assistant claim agents, who could go around and see the patients in conjunction with the surgeons, and ask such questions as may have a direct bearing upon the legal aspects of the cases, and leave the surgeon to pursue the purely medical part of his profession. This question is a very delicate one, and I am not clear in my own mind as to what would be the best practice. Of course, all of the information that the surgeon obtained in seeing these cases, which may be of value to the railway company, he is in duty bound to furnish, and this testimony is usually pure and undefiled, because it is procured so early.

A railroad could settle most of its claims through its physicians, and it might be wise to make local surgeons assistant claim agents, as employes and injured persons persist in looking upon the surgeons as hirelings of the corporation anyhow, and the amount awarded in a given case nearly always depends upon the dictum of the company surgeon.

Dr. J. P. Lord, Omaha—The more I have seen of the spirit actuating the larger, broader and more generous railway corporations, to employ not only the best talent they can procure in all of the offices of their companies, but men who are among the best morally, who have the highest ideals of justice and right, the more deeply am I impressed with their desire to be fair. It has been my repeated observation that it is the continual desire of these corporations to arrive at the truth and to do justice; they are always willing and ready to make a settlement with an injured employe or a passenger on that basis. It is only exceptionally that we see a railroad which is conducted on a purely selfish and narrow-gauge plan with claim agents of the lower type in their employ, who seek to increase their salaries by brow-beating, and resorting to practices which are disreputable in securing the most favorable settlements. I think that the better class of railway companies are getting away from this last described practice, and I believe there is no desire on their part to pursue that policy. It reacts and does not pay. It is therefore becoming of us to co-operate with them in arriving at the truth, which will enable them to carry out a more ideal form of treatment, to these unfortunates, and I can not but believe that this will come to be appreciated by the people. I think there is already a different feeling on part of the public toward railway corporations in that respect. I know that some of the larger and stronger legal corporations in our city are presided over by men who, in other walks of life,

are actuated by the higher Christian ideals of conduct, and are perfectly willing to accord that kind of treatment to those who are unfortunate enough to be injured while in their employ or under other circumstances. I think that these corporations desire their surgeons to act in that capacity. There is going to be a better general understanding. If we could live up to that ideal, there will not be that coldness alluded to by Dr. Sneve on part of the injured, towards the railroad surgeon. The railroad surgeon should be careful to so conduct himself as not to overreach his function, in prying into matters which do not concern him directly. The bare skeleton of information obtained by the surgeon, which may be entirely professional, should be turned over to the legal department and amplified by the attorney of the company without compromising the physician.

Dr. C. D. Evans, Columbus, Nebraska—I esteem highly the Judge's paper. These cases come under our observation almost daily, and I think the railway surgeons will bear me out in saying that they are in trouble sometimes in acting honestly with their patients; they are in trouble in acting honestly with the railway company; they are in trouble in acting honestly with the claim agent unless they can get rid of the pettifogging lawyer. I want to illustrate by reporting a case. A short time ago a lady, in passing from a coach at the rear end of the train, was about to turn to the steps, when the train gave a jerk forward. She was thrown from the steps on to the track. I was sent for and had to travel about twenty-five miles. She was taken to a hotel. When I reached her room I found two pettifogging lawyers with her. I could not talk to the woman or to her husband; I could not talk to any one concerned on their side of the case. When I approached the lawyers, everything was settled. The railroad company and the railway surgeon were nowhere. The woman remained in the hotel for about two weeks. I examined her thoroughly a week afterwards, by using a little strategy, and could find nothing the matter with her. During a conversation she would forget herself once in a while and roll around in bed, converse in a jolly manner, talk about everything, but when she was reminded of her injuries she became quiet. Those are the things we have to contend with. If we could keep away the unprincipled lawyers, or get to see the patients before these lawyers see them we could serve the patients a good turn, and do our duty to the railway company we represent.

We have seen what a great therapeutic agent an early settlement is. We should insist, if possible, on doing justice to our patient, and doing our duty to the railway company. We should insist strongly on claim agents making an early settlement, which would do away with many of the cases of so-called neu-

rasthenia which we have to contend with so often in courts. The only thing I strive for in adjusting these cases is, if possible, to get there before the lawyer, to act honestly with the patient; if he is an intelligent person we can do so. Frequently we meet patients who are bull-headed and will listen to nothing. They give us and everybody trouble, and finally we have to resort to the courts. I would suggest that the railway surgeon, in dealing with this class of cases, exert every effort to see these patients before the lawyers. By so doing, much trouble would be saved; it would result in greater good to the company, and much more benefit to our patient.

JUDGE DURHAM (closing the discussion)—In my paper I endeavored to bring out the point that the surgeon is in a position to learn what has transpired immediately before an accident, and that therefore he is and should be the first person to obtain information that will be valuable in the case afterward. I have known of instances, which have come under my personal observation, where the learning of facts pertaining to accidents and the occurrences afterwards have proven valuable sometimes in the settlement of cases, and it is those I would suggest that the physician and surgeon should make note of and see to.

Another important point is for the railway surgeon to question injured persons, if possible, before they have been reached by unscrupulous attorneys, or persons who are endeavoring to stir up litigation, with a view of determining the truth of the whole matter. At such a time the injured are inclined to tell those things which might bear either for or against them; it does not matter which, if they tell the truth, so that a just claim may be determined upon from those statements.

COCAIN ANALGESIA.

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I had hoped to have presented for your consideration a more elaborately prepared paper on another subject, but my time has been so fully occupied lately I am forced to offer you in its place a paper on cocain, which, while little more than a report of my own experience, may not, I hope, prove wholly without interest.

Shortly after the introduction of cocain as a local analgesic Dr. Corning, in an excellent monograph on the subject, described a method of using it which, if generally adopted, would have very widely extended its sphere of usefulness. His method, with which we are all now familiar, consisted, briefly, in confining the analgesic power of the drug to a limited area by means of an Esmarch bandage applied above and below the field of operation. In 1891 I reported an amputation of the leg.[1] In this operation I employed cocain with the most satisfactory result. Shortly thereafter I did a thigh operation. and about a year later seven other major amputations and removed a large adipose growth from the popliteal region, all of which were reported in the same journal.

For some reason surgeons generally have been loth to adopt its use in any except minor operations. If in

1. N. Y. Internat. Jour. of Surg.

chloroform and ether we have anesthetic agents devoid of danger and free from objections we need go no further, but that death does sometimes result from their employment must be admitted. Indeed, were we as careful to report disaster as we are to chronicle successes the fatality list might be larger than is generally supposed. Then, too, that permanent constitutional impairment follows their use is by no means improbable. However, admitting the comparative safety of pulmonary anesthetics, there are other considerations that might render cocain worthy of trial, such as the fact that it can be used without assistance, that it does not produce loss of consciousness, and that it is not followed by distressing nausea. In that condition of profound shock so commonly observed in the victims of railway accidents where an amputation is required, cocain has, in my hands, given the happiest results. I am well aware there are surgeons who do not hesitate to give chloroform during continuance of shock. I have more than once witnessed its administration in such cases, and in each instance the patient died. My experience, so far, with cocain has been so satisfactory that I can but wonder at the hesitancy of the profession in adopting it, and for this reason I am particularly desirous of recounting my own experience with it as an analgesic in operations of more or less magnitude.

Up to this date I have employed cocain in operations for lacerated cervix. hemorrhoids, extraction of great-toe nails, removal of tumors from the scalp, face, thorax, arms and one enormous adipose tumor deeply seated and with numerous attachments from the popliteal region, and done twenty major amputations, including three at the thigh; also one extensive osteotomy. In addition to these amputations of my own, one at the middle of the thigh, done by my friend, Dr. R. W. Fry, of Roanoke, Va., and two recently reported by Dr. Thomas H. Manley, of New York City—one of the mid-

thigh and one at the mid-forearm—make in all twenty-three major amputations of which I have knowledge. To this list may be added operations done of later years for the removal of ovarian cysts, for suprapubic cystotomy, and Bassini's operation for the radical cure of hernia. In fact, I believe Prof. Thos. H. Manley used cocain in the latter operation somewhere in the early 90's. To those who feel an interest in this subject I would suggest a perusal of Manley's work on cocain analgesia, which is replete with valuable advice as to the proper use of cocain, its dosage, technique of application, its limitations, etc.

Among the objections urged against cocain are its danger to life—which I conceive to be far less than that of any pulmonary anesthetic, provided due care be used in its administration—and the uncertainty of its analgesic effect, especially in the deeper tissues. This has not been, in my experience, a valid objection. I think its failure in the hands of some operators is due to the fact that they operate too shortly after its injection. After the application of the Esmarch and injection of the drug I am in the habit of waiting 10, sometimes 15, minutes before operating. In operations on the trunk or in situations where a rubber bandage is not available the amount injected should be smaller and quickly followed by the incision in order that the flow of blood may allow the rapid escape of the surplus cocain from the tissues, thereby lessening the danger of its toxic action from absorption. Prof. John A. Wyeth's method, which consists in injecting a small amount, making a superficial incision, again injecting deeper, and making a deeper cut, is especially deserving of mention. I can bear testimony to its value. It has also been claimed that cocain interferes with the reparative process. A non-sterilized syringe or old solution, or unclean hands or instruments would, if the truth were known, be found responsible for the trouble here.

I would not have you infer from the foregoing report that I by any means advocate the use of cocain to the exclusion of pulmonary anesthetics in every case and under all circumstances. It should be used only in selected cases and with the utmost caution, as it is equally necessary with both ether and chloroform. It is, in my estimation, particularly adapted to operations on the limbs, where the rubber bandage can be used, thereby preventing at least rapid absorption and the sudden toxic effects of the drug, and I should mention here that I invariably apply the bandage before injecting the cocain. This is far safer than first to inject and then apply constriction. It has been argued by some surgeons with whom I have talked that constriction applied before the injection of the drug would so thoroughly confine it to the actual point of injection that its analgesic effect on immediately surrounding tissues would amount to nothing. As a matter of fact I have not found this to be the case. While its analgesic effect on contiguous structures is undoubtedly delayed, it is more permanent. I frequently find it necessary, however, to knead the soft tissues, which procedure, I presume, not only acts mechanically, diffusing the fluid through adjacent parts, but stimulates the absorptive properties of the tissues. There will naturally be some venous loss during the progress of an operation, which has a salutary effect in ridding the part to a large extent of the now no longer needed drug. I am, however, always careful to thoroughly irrigate the wound after the operation, before removing the Esmarch. This, the last step in the procedure, should be done with due caution.

That in certain operations cocain can never take the place of pulmonary anesthetics, that there are limitations to its use, or that alarming symptoms and even deaths have been reported, are not valid objections. A careful investigation of those cases where untoward or

fatal results supervened would probably reveal error of judgment or carelessness on the part of the surgeon, except in those cases of unusual susceptibility, where the result would probably have been the same with pulmonary anesthesia. I have seen cocain used in the throat by specialists, and by dentists for extraction of teeth, in quantities which I am now satisfied were dangerous, and indeed, in my earlier operations I know that I erred both in the strength of my solution and in the quantity injected. My attention was first directed to this point by Dr. Wyeth, who advised me not to use a solution of greater strength than 2 per cent., as I would thereby not only minimize the danger of constitutional effects, but would obtain as complete analgesia. The adoption of Dr. Wyeth's advice taught me a valuable lesson, and indeed, in my last few amputations I have used 1 per cent. solutions, and only recently I removed a tumor about the size of an egg from the forearm with a .5 per cent. solution, using but fifteen to twenty drops of it, without inflicting the slightest pain.

328 West Forty-second Street.

NON-CONSTRICTIVE DRESSINGS FOR FRACTURES

J. F. PRITCHARD, M.D.

DISTRICT SURGEON TO THE C. & N.-W. R.R. CO.

MANITOWOC, WIS.

It should be our aim and object in the treatment of diseases and injuries to under no circumstances interfere with the beneficent effort of Nature. In the treatment of fractures with our cumbersome splints and dressings with many and constrictive forms of bandages of myriad name and nature, with material in some cases so heavy as to make the patient weary with its ponderosity, is it not time to stop and review the whole subject of this form of treatment and study it in its simplicity, aiming to aid and not retard Nature in her effort at repair. We should remember that all indications are fulfilled if the broken fragments of bone are in apposition and at rest. This rule of rest applies to all injuries, but at this time I wish to limit the question to the treatment of fracture, although the principle is the same, in a large measure, in all.

We all know that an immobile circulation will give a more rapid healing process than if injured in the slightest degree. And why should we disturb the circulation? Can we do so by our dressings as to meet all indications in the treatment and yet not interfere with the circulation? I think we can in nearly every instance.

I am well aware that this is contrary to ordinary teaching, and you may answer that it can be done in but few cases. It will surprise you, however, to find in how many cases, and what fine results you will have without constrictive dressings.

The old and well-tried fracture-box is one of the forms in which the principle is applied partially, but here we have lateral pressure and thus far defeat the plan of avoiding any interference with the circulation. There is for all fractures of the leg and thigh a plan of suspension that meets all requirements. By means of an iron rod properly bent, the so-called Hodgen's splint is a form that can be easily used and is almost always available. It can be made in a few minutes by an ordinary mechanic, or by the surgeon himself if he has the proper mechanical skill to practice his profession. Additional to the rod, a few safety-pins, a piece of cloth to make a suspension for the leg, a cord to suspend the leg when the splint is adjusted, and your dressing is complete. It can be used in all cases of leg and thigh fracture, and can be adjusted to any degree of flexion by merely bending the rod at the knee; extension can easily be applied by adjusting the bed to the point of attachment of the cord to the ceiling. Many surgeons will agree as to its usefulness in fractures of the leg, but if you will study recent reports you will find the best results in treatment of fractures of the femur by this means. There should be no constriction whatever. The patient can move about to a limited degree in his bed, and he can not displace the fragments if the ordinary mechanical principles are complied with.

Compound fractures can be as easily and comfortably dressed as if the fracture were uncomplicated. If a foot-piece is needed, it can be made by cutting in a piece of board at the proper angle, and by means of wedges this can be adjusted to completely support the foot, but in most instances the needed support to the foot

is had by making a stirrup of a piece of bandage and attaching it to the splint higher up. I do not insist on this special form of splint, but insist that the principle should be applied, and mention this form only for its simplicity, availability and effectiveness.

A modified form of application of Hodgen's consists in supporting the leg by short strips of bandage fastened on either side, preferably by safety-pins, to admit of free inspection of all parts of the injured limb without disturbance.

For the arm the principle of [illegible] dressings can be applied in a modified form either by a trough or in some other simple manner [illegible] wire. In clavicle fractures, by requiring the patient to lie on his back in a firm smooth manner, [illegible] are fulfilled and results are [illegible].

I need not mention the trouble and [illegible] with splints and ordinary dressings but [illegible] ready-made splints remind me of [illegible] man with one pair of [illegible] it for the individual.

Remembering the principle of [illegible] limb, the splint applied with [illegible] on with a very few strips of bandage [illegible] far safer than one applied with [illegible] with many turns. [illegible] the stripe, but not [illegible] cutting it entirely away.

Plaster-of-Paris splints [illegible] any circumstances [illegible] may be very radical, as a [illegible] of practical experience [illegible] many unfortunate [illegible] a plaster cast is—that [illegible] How difficult, if it is [illegible] to inspect the fracture [illegible] you may ask when [illegible]

has subsided, absorption of extravasated blood taken place, and you wish to give your patient his freedom during convalescence. Practically then, use plaster-of-Paris dressing after the bone has united and you wish to protect the point of injury from possible results of attempting to move about. Another point is, under no circumstances use this dressing without plenty of cotton or other padding next the skin. It is never proper to use plaster-of-Paris without this plentiful layer of cotton.

There are many forms of retentive dressings which come and have a trial and are forgotten. Many of them, like wigan, silicate, starch, wire-cloth and others have advocates, and all are useful, but useful only when convenient. We have these things in mind only to be applied when they are easily reached. But under no circumstances can all fractures be dressed with one form of dressing or one kind of splint. You can find bark or a limb of a tree in the forest, that will make a splint to fit the case in hand, and I believe that every surgeon ought to be able to dress his case of fracture with what he can find on the spot. If he expects to manage such cases successfully, he should have mechanical ingenuity to adapt conditions to his needs and not be helpless because he may not have his favorite dressings with him. But these are all to be considered as temporary and applied to meet the needs of transportation, and in all cases when the patient reaches his home or a permanent residence he should have a non-constrictive dressing and be made comfortable.

I can give positive results from actual experience in many cases with this principle applied, but one of each kind will be more than enough.

Case 1.—A railroad brakeman had his leg broken by a derailment, a car crushing him. He received an immediate dressing of plaster-of-Paris, and within a short time, from constriction of the dressings, the pain

became unbearable and, when first seen by me, the dressing had been cut, the leg was covered with large blisters, was very much swollen and still painful. This visit was at night, but by making a sketch and giving an ordinarily bright young man directions, he brought a splint—Hodgen's—ready for use in less than an hour. After suspending the leg and adjusting the short strips of bandage there was no further trouble, and healing was uneventful.

CASE 2.—An impacted fracture of the neck of the femur was treated with a similar splint and sand-bags, with a good recovery, a useful limb, and no unpleasant symptoms. This patient was a woman, very much emaciated and neurasthenic. She now walks with scarcely a perceptible limp.

CASE 3.—A crushing injury of the leg was caused by a heavy log striking it, in a man of 55, of phlegmatic temperament. He was dressed in a fracture-box at first, applied very loosely, but swelling occurred to such an extent that I was obliged to suspend the leg and remove every form of constriction. Enormously large blisters, filled with bloody serum, extended from the knee to the ankle, the foot was cold, and every appearance of gangrene occurred, yet by suspension and non-constriction I succeeded in getting a result which, being slow—about two months—was as perfect as if in a younger man with a better constitution. In this case there was no possibility of saving limb or life with any form of constriction.

CASE 4.—This was similar to Case 3 in every way, as to constitution and conditions of the system. The injury was a fracture of the malleoli with dislocation. Four hours after the injury I found the patient as free from pain as if he had sustained no hurt; he had slept and was comfortable, and yet there was complete displacement with laceration of all structures at the ankle-joint, sharp fragments of bone pressing dangerously on

the skin to such an extent that perforation was almost complete. There was no sensation on reduction. Blisters similar to those in Case 3 formed over the injured parts. Similar open treatment was given, with good recovery in a reasonable time.

CASE 5.—This was a fracture of the middle third of the femur, with contusions of various parts of the body. The patient had been struck by an engine on a crossing. Suspension, non-constriction and healing without shortening was secured.

In some of these cases any form of constriction would have produced disaster, and if we get good results in our worst cases with such dressings, how much better must be the healing powers in the ordinary case. How much anxiety is saved by the ready inspection, ease and comfort and gain in time to the patient!

PROCEEDINGS OF THE SIXTH ANNUAL MEETING OF THE AMERICAN ACADEMY OF RAILWAY SURGEONS

FIRST DAY—MORNING SESSION.

EXECUTIVE SESSION.

The Academy convened in the Supreme Court Room of the State Capitol, in the city of St. Paul, Minnesota, at 10 o'clock a. m. Sept. 5, 1900 (Wednesday), with Dr. C. A. Wheaton, President, in the chair.

DR. ALEX. J. STONE, for the Committee on Arrangements, welcomed the Academy to the City in the name of the profession. He then introduced Colonel Rosing, representing the Governor of the State, who, in a short address, bade the Academy God-peed in its work.

DR. STONE then presented Acting Mayor Schiffman, who kindly extended the courtesies of the City to the Fellows of the Academy.

The Academy was then called to order by the President, and the regular order of business taken up.

DR. STONE announced that the Fellows of the Academy were invited to a social smoker at the Minnesota Club Rooms at 8 o'clock p. m.

Telegrams of regrets were read from Dr. R. Harvey Reed, and Dr. H. L. Getz, President of the International Association of Railway Surgeons.

On motion the President appointed Drs. J. E. Owens, W. J. Mayo and W. L. Estes to act as an Executive Board.

Application for fellowship were read from:

Dr. J. F. Baker, Surgeon Wis. Cent. R'y, St. Paul, Minn.

Dr. D. W. Day, Surgeon Wis. Cent., C., M. & St. P., and C., St. P., M. & O. R'y Co's, Eau Claire, Wis.

Dr. J. M. Dixon, Chief Surgeon C., P. and St. L. R'y, Springfield, Ill.

Dr. Jas. H. Dunn, Surgeon Gr. Nor. R'y, Minneapolis, Minn.

Dr. D. W. Hayes, Div. Surgeon Can. Pac. R'y, Brownville Jct., Me.

Dr. Jas. G. Hunt, Div. Surgeon N. Y., O. & W. R'y, Utica, N. Y.

Dr. F. H. McNaught, Asst. Chief Surgeon C. & S. R'y, Denver, Colo.

Dr. W. B. Morrow, Div. Surgeon N. Y., O. & W. R'y, Walton, N. Y.

Dr. O. C. Stickler, Surgeon C. & N. W., and M. & St. L. R'ys, New Ulm, Minn.

Dr. F W. Winger, Div. Surgeon Erie R'y, Bradford, Pa.

Dr. H. M. Workman, Dist. Surgeon C. & N. W. R'y, Tracy, Minn.

Dr Wm. E. Jewett, Surgeon L., S. & M. S. R'y, Adrian, Mich.

All of which were referred to the Executive Board.

The bill of the American Medical Association for printing Transactions, amounting to $162, was read.

Bill of Secretary T. B. Lacey, for sundry items in connection with his office, amounting to $67.57 was read. Both bills were referred to the Executive Board.

Invitations to hold the next session in their respective places were received and read, from Hotel Victory, Put-in-Bay, Ohio; Citizens' Business League, Milwaukee, Wis.; Business League, Cincinnati, Ohio.

Dr. John E. Owens, Chairman of Committee on Transportation, presented the following report:

"Shortly after June 7, 1900, a letter was sent to each of fifty-three (53) railroads (names omitted on accounct of space). Of this number we had received replies from only forty-one (41) on July 24, 1900, when a letter was sent to each of those roads that had not replied. At this date, Aug. 27, 1900, eight (8) railroad companies had not replied. The replies that were received are all favorable, but in seven (7) instances certain conditions were expressed. (Items omitted on account of space.)

"The Committee would respectfully recommend that, in order to facilitate the work of future committees on transportation, the names of railroad companies be printed in full in the Transactions.

"It would further recommend that a committee of one (1) be appointed by the President to bring to the notice of those who formulate the Eastern and Western Passenger Agreements, the Academy, its objects, the character of its work, and to furnish such other information as will place us on a footing that will obtain transportation for our Fellows, from all railroad companies in which we are interested, and that copies of Transactions just published, with the Program of this meeting, be furnished the Chairman of the Railroad Committes above referred to.

John E. Owens, Chairman,
W. W. Grant,
C. K. Cole, *Committee.*"

On motion, seconded and carried, the Report was adopted and the recommendations concurred in.

On motion, carried, a vote of thanks was given the Committee for the thoroughness of its work.

On motion, carried, a recess of ten (10) minutes was taken.

The Academy was again called to order. The Executive Board reported favorably on the applications for Fellowship of Drs. J. F. Baker, D. W. Day, J. N. Dixon, Jas. H. Dunn, D. W. Hayes, Jas. G Hunt, F. H. McNaught, W. B. Morrow, O. C. Strickler, F. W. Winger and H. M. Workman.

On motion, carried, the Secretary was instructed to cast the ballot for said applicants; the same was done, and the above named declared duly elected to Fellowship.

On the application of Dr. Wm. E. Jewett the Executive Board reported that "We would ask for certificates of membership in the American Medical Association and in the Michigan State Medical Society (Regular); also letters from Drs. Wyman and McLean, and in the meantime invite him to participate in our work."

On motion, carried, the report was adopted.

On motion, carried, the Academy adjourned till 2 o'clock p. m.

First Day—Afternoon Session.

The Academy was called to order by the President at 2:15 p. m.

SCIENTIFIC SESSION.

C. O. Hunter, Esq., read a paper entitled "Remedies." Discussion by Drs. Grant, Eskridge, Lacey, Estes, Lord, Mayo, Butler, C. K. Cole and Owens; closed by Mr. Hunter.

Dr. Haldor Sneve read a paper on "How to Treat the Muscular and Joint Sprains of Railway Employes." Discussion by Drs. Butler, Eskridge, Lord and German; closed by Dr. Sneve.

Dr. W. W. Grant presented a paper and skiagrams on "Fractures of the Elbow Joint." Discussion by Drs. Mayo, Schooler and Smouse; closed by Dr. Grant.

Dr. W. J. Mayo presented a paper entitled "The Open Treatment of Septic Knee Joints." Discussion by Drs. Grant, Fairchild and Owens; closed by Dr. Mayo.

Dr. D. S. Fairchild read a paper on "Some Additional Observations on the Effects of Injury to the Peripheral Nerves." Discussion by Dr. Eskridge; closed by Dr. Fairchild.

Dr. W. L. Estes presented a paper on "Hospital Cars on Railways." Discussion by Drs. Lacey, Mayo and Lord; closed by Dr. Estes.

On motion, carried, the Academy adjourned till 9:30 o'clock the following morning.

SECOND DAY—MORNING SESSION.

EXECUTIVE SESSION.

A communication from Dr. J. F. Bancroft, of Denver, Colo., stating that owing to age he could not give attention to Academy duties, was read.

On motion, carried, Dr. Bancroft was placed on the Honorary List.

Resignation of Dr. Jesse Hawes, of Greeley, Colo., was read. On motion, carried, the same was accepted, conditioned on the payment, by him, of the amount due the Academy.

The Committee on Betterment reported as follows:

CHICAGO, ILL., Aug. 31, 1900.

To the American Academy of Railway Surgeons:

At our last meeting in Omaha, the President, Drs. Lacey, Eskridge and Owens were appointed a Committee to report at this meeting on the "Betterment of the Academy." On February 1st I received a letter from the President asking me to act as Chairman of this Committee. The Committee agreed upon the following letter, which, on or after June 6, was sent to Dr. Lacey to be printed and distributed:

MY DEAR DOCTOR: At the last meeting of the Academy of Railway Surgeons, held in Omaha, Oct. 12 and 13, 1899, a Committee was appointed to communicate with all the members of the Academy and urge them to contribute to its success by reading papers if possible, and by their presence.

In the debate during which this resolution was pending, it was evidently the sense of the meeting that the Fellows of the Academy of Railway Surgeons should do better and more technical work than the General Association of Railway Surgeons. It was finally resolved that the accomplishment of higher work in railroad surgery and medicine should be our aim. We appeal to you personally to contribute a paper at our next meeting, and if possible to be present and take part in the discussions.

As we are a Committee on the "Betterment of the Academy" to report at its next meeting, we most respectfully urge you to give this matter your earnest consideration, and to favor us very promptly with any suggestions which you can make to this end. We shall expect to hear from every Fellow on this matter within three weeks from this date.

We must all take a deep personal interest in the welfare of the Academy, and do everything in our power to accomplish the object for which the Academy of Railway Surgeons was organized.

You have no doubt been notified of the time of the meeting and have been asked for a contribution by our Secretary, Dr. T. B. Lacey. If you have not already done so, please communicate with him during the next thirty days, informing him whether or not you can be present, and giving him the title of your paper so that his work may be in condition for his

final announcement to the Fellows of the Academy, preliminary to the meeting to be held at St. Paul, Minn., Sept. 5 and 6.

Address answers to this communication concerning the "Betterment of the Academy" to John E. Owens, Chairman, 1806 Michigan Avenue, Chicago, Ill.

JOHN E. OWENS, Chairman.
C. A. WHEATON,
J. T. ESKRIDGE,
T. B. LACEY, *Committee.*

Exclusive of the members of the Committee, the Chairman received only six replies, viz., from Drs. German, Gardner, Pritchard, Hawes, Harvey, Reed and Bancroft.

Your Committee begs leave to recommend:

1. That the Chief Surgeons of the Academy be encouraged to appoint as consultants, leading men of such specialties as may be of service to the medical or surgical departments of their railroads respectively.

2. That said appointees be encouraged to become Fellows of the Academy.

3. That in the opinion of the Committee the Academy would thereby be able to do more scientific work, and to thereby elevate its standard.

4. That the Executive Committee each year arrange a symposium for the coming regular meeting, and to assign Fellows to prepare short papers, each of about ten minutes in length on different parts of the subject for discussion. The author of the first or chief paper shall not consume more than twenty minutes.

5. That the balance of the papers for the program be prepared and read by Fellows whose name appears on our official list, except the President and Secretary, and such Fellows as may have been assigned to take part in the symposium, unless these gentlemen desire to prepare papers.

6. That if for good and sufficient reasons a Fellow finds himself unable to read a paper in the order as shall be prepared to read a paper at the next succeeding meeting.

7. That the Academy encourage every Fellow a special agent to work for its best interests.

8. That a committee of one be appointed by the President to confer with the Chief Surgeons of the country and with other able and scientific railroad surgeons with a view of inducing them to become Fellows of the American Academy of Railway Surgeons.

All of which is respectfully submitted.

JOHN E. OWENS, Chairman.
C. A. WHEATON,
J. T. ESKRIDGE,
T. B. LACEY, *Committee.*

On motion, carried, the above report was adopted, and the recommendations concurred in.

DR. D. S. FAIRCHILD then presented his report as Treasurer, which is as follows:

The following report of the Treasurer is respectfully submitted.

Debit—		
To balance from former Treasurer		$12.41
To checks, former Treasurer		10.00
To cash, Dr. L. C. Ford		5.00
To cash, received at Omaha session		85.00
To cash, dues received since Omaha session		100.00
To cash, fee from Dr. M. Cavana		5.00
		$217.41
Credit—		
By, paid Dr. T. B. Lacey, as per vouchers	$38.05	
By, paid Dr. T. B. Lacey, exchange	.20	
By, paid Dr. F. J. Hodges, as per vouchers	14.25	52.50
Balance on hand Sept. 5, 1900		$164.91
Debit—		
To balance on hand Sept. 5, 1900		$164.91
To cash received at St. Paul session		145.00
To cash received since St. Paul session		15.00
		$324.91
Credit—		
By cash paid Dr. Lacey as per vouchers	$67.57	
By cash paid Journal Am. Med. Assoc., bill	162.00	
By cash paid postage and receipt book	2.15	$231.72
Balance on hand		$93.19

Respectfully submitted,
D. S. FAIRCHILD, Treasurer.

On motion, carried, the Treasurer was instructed to again notify all delinquents, urging them to pay their dues.

On motion, carried, Fellows who had been charged ten dollars ($10) on joining the Academy shall be credited with five dollars ($5), and that the membership fee only be charged new members.

Resignations were read from Drs. C. M. Daniels, G. W. Crile, H. J. Williams and H. McHatton. As their dues are paid to date, the same were, on motion, accepted.

SCIENTIFIC SESSION.

DR. J. T. ESKRIDGE presented a paper entitled "A Study of the Plantar Reflexes with Especial Reference to the Babinsky Sign." No discussion.

JUDGE E. A. JAGGARD addressed the Academy on the subject of "Some Aspects of Medical Testimony." Discussion by Drs. Grant, Eskridge and Owens; closed by Judge Jaggard.

DR. GRANT moved that the Academy extend a vote of thanks to the Judge for his able and interesting address, which was seconded and carried.

DR. OWENS moved that Judge Jaggard be elected an Honorary member of this Academy; the same was seconded and carried.

DR. E. O. N. KANE read a paper on "New Method for Rapid

Intestinal Anastomosis," with instrument. Discussion by Drs. Lord and Cole: closed by Dr. Kane.

The president then read his Address entitled "Some of the Needs of the Academy."

On motion the President's Address was referred to a special committee composed of Drs. Cole, Owens and Estes, with instruction to report this afternoon.

On motion, carried, the Academy adjourned until 2:00 p. m. sharp.

SECOND DAY—AFTERNOON SESSION.

EXECUTIVE SESSION.

Academy called to order by the President at 2:00 p. m.

The Election of Officers for the ensuing year being fixed for this time, the same was proceeded with, and the following elected:

President: Dr. D. S. Fairchild, Clinton, Iowa.
First Vice-President: Dr. W. L. Estes, South Bethehem, Pa.
Second Vice-President: Dr. W. J. Mayo, Rochester, Minn.
Secretary-Treasurer: Dr. T. B. Lacey, Council Bluffs, Iowa.
Editor: Dr. T. B. Lacey, Council Bluffs, Iowa.

EXECUTIVE BOARD.

Dr. W. W. Grant, Denver, Colo., term expires 1903.
Dr. C. K. Cole, Helena, Mont., term expires 1902.
Dr. M. Cavana, Sylvan Beach, N. Y., term expires 1901.

On motion, carried, Chicago, Ill., was the place selected for the holding of our next session.

On motion, carried the date of our next session was left to be determined by the Executive Board.

The special committee on the President's Address made the following report:

"The committee on the President's Address recommend that the Secretary arrange for an early publication of the Address in the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION and that he procure 300 reprints of said Address to be distributed to the General Managers and Chief Surgeons of this country, and to make such other distribution of the remainder as he may think best.

C. K. COLE,
J. E. OWENS,
W. L. ESTES,
Committee."

On motion, carried, the report and recommendations were adopted.

SCIENTIFIC SESSION.

DR. WILLIAM H. GERMAN presented a paper on "Surgical Shock." Discussion by Dr. Jennings; closed by Dr. German.

A paper entitled "Keloid Growths Following Traumatism," with photographs, was read by title.

DR. JAS. H. DUNN presented a paper on "The Diagnosis and Treatment of Injuries of the Head," with diagrams and instruments. Discussion by Drs. Cole, Grant, Estes, Eskridge, Cavana and Lord; closed by Dr. Dunn.

DR. WILLIAM C. BANE presented a paper on "Chip of Iron in Eye.—Examination with Fluoroscope, Negative, and with Sideroscope, Positive.—Eye Enucleated.—Sympathetic Ophthalmitis Sixteen Days Later.—Recovery.—Exhibition of Sideroscope." No discussion.

DR. M. CAVANA read a paper entitled "Railway Injuries Resulting from Personal Negligence." No discussion.

JUDGE J. T. DURHAM presented a paper on the subject of "The Railway Surgeon a Valuable Aid in the Settlement of Claims for Damages." Discussion by Drs. Cavana, Cole, Sneve, Lord and Evans; closed by Judge Durham.

EXECUTIVE SESSION.

The President appointed Drs. Owens, Grant and C. K. Cole as the Committee on Transportation.

DR. JOHN E. OWENS was appointed as the Committee on Arrangements for our next session.

On motion, carried, Dr. A. D. Beban and Judge J. T. Durham, were elected to Honorary Fellowship.

On motion, carried, it was determined that our next session should be of two (2) days' duration.

The President appointed Dr. C. A. Wheaton a committee of one to confer with the chief surgeons of the country, and with other able and scientific Railroad Surgeons, with a view of inducing them to become Fellows of this Academy.

The President appointed Dr. John E. Owens as a committee of one to bring to the notice of those who formulate the Eastern and Western Passenger Agreements, the Academy, its objects, the character of its work, and to furnish such other information as will place us on a footing that will obtain transportation for our Fellows from all Railway Companies in which we are interested.

On motion, carried, the Academy adjourned *sine die.*

T. B. LACEY, Secretary.

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Dr. David C. Ainey; New Milford, Pa. Asst.-Surgeon Delaware, Lackawanna & Western R'y.
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Dr. E. Wyllys Andrews; Chicago, Ill. Surgeon Wabash R'y.
Dr. W. W. Appley; Cochecton, N. Y. Surgeon New York, Lake Erie & Western R'y.
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Dr. J. F. Baker; St. Paul, Minn. Surgeon Wisconsin Central R'y.
Dr. S. C. Baldwin; Salt Lake City, Utah. Chief Surgeon Salt Lake & Ogden R'y.
Dr. Wm. C. Bane; Denver, Colo. Oculist and Aurist Chicago, Rock Island & Pacific R'y.
Dr. Amos W. Barber; Cheyenne, Wyo. Surgeon Union Pacific, Denver & Gulf R'y.
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Dr. Henry Chapplo; Billings, Mont. Surgeon Union Pacific R'y.
Dr. Henry Coe; Portland, Ore. Surgeon East Side R'y.
Dr. C. K. Cole; Helena, Mont. Chief Surgeon Montana Central R'y.

Dr. W. U. Cole; Columbus, Ohio. Chief Surgeon Hocking Valley and Toledo & Ohio Central R'y.

Dr. G. P. Conn; Concord, N. H. Chief Surgeon Concord & Maine R'y.

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Dr. Edward Dooley; Buffalo, N. Y. Surgeon New York, Lake Erie & Western R'y.

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Dr. J. B. Eagleson; Seattle, Wash. Division Surgeon Great Northern R'y.

Dr. A. E. Ellinwood; Attica, N. Y. Surgeon Erie R'y.

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Dr. T. C. Kennedy; Shelbyville, Ind. Surgeon Big Four R'y.
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Dr. Wm. Thompson; Philadelphia, Pa. Oculist Pennsylvania R'y.
Dr. E. H. Trickle; Cutler, Ohio. Surgeon Toledo & Ohio Central R'y.
Dr. B. H. Van Kirk; West Newton, Pa. Surgeon Baltimore & Ohio R'y.
Dr. O. J. Veline; Kerkhoven, Minn. Surgeon Great Northern R'y.
Dr. G. A. Wall; Topeka, Kan. Oculist Atchison, Topeka & Santa Fe R'y.

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Dr. A. L. Wright; Carroll, Iowa. District Surgeon Chicago North-Western R'y.
Dr. F. W. Whitcomb; Warren, Pa. Surgeon Dunkirk, Allegheny Valley & Pittsburg.

HONORARY FELLOWS.

Hon. Tracy C. Becker; Buffalo, N. Y. 1896.
Robt. Mather, Esq.; Chicago, Ill. 1896.
Dr. James E. Pilcher; U. S. A. 1896.
C. O. Hunter, Esq.; Columbus, Ohio. 1897.
Dr. W. H. Elliott; Savannah, Ga. 1898.
Dr. W. H. Meyers; Meyersdale, Pa. 1898.
Dr. F. H. Peck; Utica, N. Y. 1898.

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